R48/2

United States
Department of
Agriculture

Forest Service

Intermountain
Region

R4-Ecol-85-01

December 1985

Riparian Community Type Classification of Eastern Idaho - Western Wyoming

Andrew P. Youngblood,
Wayne G. Padgett,
and Alma H. Winward

NEWARK PUBLIC LIBRARY
MAR 10 1986
U. S. GOVT. PUBS.
DEPOSITORY 276

A13.2:

THE AUTHORS

ANDREW P. YOUNGBLOOD is an ecologist for the Intermountain Region, Forest Service, U. S. Department of Agriculture. He holds a B.S. degree in forest management and an M.S. degree in forest ecology from Utah State University.

WAYNE G. PADGETT is a range conservationist for the Intermountain Region, Forest Service, U. S. Department of Agriculture. He holds a B.S. degree in biological sciences from University of California-Davis and an M.S. degree in rangeland resources from Oregon State University.

ALMA H. WINWARD is regional ecologist for the Intermountain Region, Forest Service, U. S. Department of Agriculture. He holds a B.S. degree in range science from Utah State University and a Ph.D. in range ecology from the University of Idaho.

RESEARCH SUMMARY

A community type classification is presented for the riparian ecosystems of eastern Idaho and western Wyoming. The hierarchial taxonomic system of vegetation classification is based on existing riparian vegetation, and uses data from 469 sample stands. A total of 52 community types within 8 major physiognomic groups are defined and described. A diagnostic key is presented for field identification of community types based on indicator plant species. Vegetation composition, productivity, soils, and successional status are discussed.

ACKNOWLEDGMENTS

Financial support for this study was provided by the range, watershed and air quality management, timber management, wildlife management, and recreation resource functions of the Intermountain Region, Forest Service, U. S. Department of Agriculture. Portions of the fieldwork were funded through cooperative agreements with the Department of Range Science, Utah State University, or through contracts to Meiiji Resource Consultants, Layton, UT.

Many people contributed to this project over a period of six years. Early fieldwork was conducted by B. E. Norton, Philip J. Urness, Alvin R. Southard, Richard P. Young, Joel Tuhy, Sherman Jensen, Kathryn M. Mutz, Joao Queiroz, Robert Graham, and numerous field assistants from Utah State University. Robert Josaitis was an able and valuable assistant during fieldwork on the Caribou and Targhee National Forests. John Nordin and Melissa Blackwell, from the Bridger-Teton National Forest, and Bedford Cash and Ronald Wright from the Targhee National Forest provided help with the description, taxonomy, and interpretation of soils. Both Leila Shultz of the Intermountain Herbarium at Utah State University and Mont Lewis of the Intermountain Region assisted in plant taxonomy.

Intermountain Research Station support staff, especially Connie McCaughey, assisted in the preparation of the manuscript. Technical reviewers included Joel Tuhy of The Nature Conservancy, Don Bartschi of the Northern Region, Forest Service, U. S. Department of Agriculture; John Nordin and Norman Bare of the Intermountain Region, Forest Service; and Warren Clary, William Platts, and Robert Steele of the Intermountain Research Station, Forest Service.

READEX FICHE

CONTENTS

Page

Introduction . . . 1
Objectives and Scope . . . 1
Methods . . . 2
Field Methods . . . 2
Office Methods . . . 3
Taxonomic Considerations . . . 3
Synecological Perspective and Terminology . . . 4
Community Type Concept . . . 4
Riparian Ecosystems and Communities . . . 5
Physical Setting . . . 6
Physiography and Geology . . . 6
Soils . . . 7
Climate . . . 9
Upland Vegetation . . . 9
The Riparian Community Type Classification . . . 9
Key to Riparian Community Types of Eastern Idaho - Western Wyoming . . . 11
Description of Dominance Groups and Riparian Community Types . . . 17
Tree-Dominated Community Types . . . 17
Picea/Equisetum arvense c.t. . . . 18
Picea/Cornus stolonifera c.t. . . . 18
Picea/Calamagrostis canadensis c.t. . . . 20
Picea/Galium triflorum c.t. . . . 20
Populus angustifolia/Cornus stolonifera c.t. . . . 21
Populus angustifolia/Poa pratensis c.t. . . . 22
Mixed Shrub-Dominated Community Types . . . 23
Alnus incana/Ribes hudsonianum c.t. . . . 23
Cornus stolonifera/Heracleum lanatum c.t. . . . 24
Cornus stolonifera/Galium triflorum c.t. . . . 25
Rhamnus alnifolia c.t. . . . 26
Potentilla fruticosa/Deschampsia cespitosa c.t. . . . 26
Potentilla fruticosa/Festuca idahoensis c.t. . . . 27
Potentilla fruticosa/Poa pratensis c.t. . . . 28
Artemisia cana/Festuca idahoensis c.t. . . . 28
Artemisia cana/Poa pratensis c.t. . . . 30
Salix geyeriana-Dominated Community Types . . . 30
Salix geyeriana/Carex rostrata c.t. . . . 30
Salix geyeriana/Poa palustris c.t. . . . 31
Salix geyeriana/Calamagrostis canadensis c.t. . . . 32
Salix geyeriana/Mesic forb c.t. . . . 33
Salix geyeriana/Poa pratensis c.t. . . . 33
Salix boothii-Dominated Community Types . . . 34
Salix boothii/Carex rostrata c.t. . . . 34
Salix boothii/Carex nebrascensis c.t. . . . 35
Salix boothii/Calamagrostis canadensis c.t. . . . 36
Salix boothii/Equisetum arvense c.t. . . . 36
Salix boothii/Poa palustris c.t. . . . 37
Salix boothii/Smilacina stellata . . . 37
Salix boothii/Poa pratensis c.t. . . . 39
Salix wolfii-Dominated Community Types . . . 39
Salix wolfii/Carex aquatilis c.t. . . . 40
Salix wolfii/Carex rostrata c.t. . . . 41
Salix wolfii/Calamagrostis canadensis c.t. . . . 43
Salix wolfii/Carex nebrascensis c.t. . . . 43

Page

Salix wolfii/Deschampsia cespitosa c.t. . . . 43
Salix wolfii/Poa palustris c.t. . . . 44
Salix wolfii/Mesic Forb c.t. . . . 44
Other *Salix*-Dominated Community Types . . . 45
Salix exigua/Equisetum arvense c.t. . . . 45
Salix exigua/Poa pratensis c.t. . . . 46
Salix lutea c.t. . . . 47
Salix planifolia c.t. . . . 47
Salix eastwoodiae c.t. . . . 48
Graminoid-Dominated Community Types . . . 48
Carex microptera c.t. . . . 48
Carex simulata c.t. . . . 49
Carex rostrata c.t. . . . 49
Carex aquatilis c.t. . . . 51
Carex nebrascensis c.t. . . . 52
Miscellaneous Carex c.t.'s . . . 52
Juncus balticus c.t. . . . 52
Deschampsia cespitosa c.t. . . . 53
Poa palustris c.t. . . . 54
Poa pratensis c.t. . . . 54
Forb-Dominated Community Types . . . 54
Veratrum californicum c.t. . . . 54
Mertensia ciliata c.t. . . . 55
Mesic Forb Meadow c.t. . . . 55
Wetland Communities . . . 56
Unclassified Stands . . . 56
Individual Attributes of Riparian Community Types . . . 56
Ecological Role of Plant Species . . . 56
Productivity . . . 57
Soils . . . 57
Successional Relationships of Community Types . . . 57
Relationship to Previous Riparian Classifications within the Study Area . . . 58
Use of the Classification . . . 60
References . . . 62

APPENDIXES:

A. Number of sample stands by riparian community type and vicinity in eastern Idaho and western Wyoming . . . 66

B. Constancy and average cover of important plants in eastern Idaho and western Wyoming riparian community types . . . 68

C. Herbaceous productivity of major eastern Idaho-western Wyoming riparian community types . . . 71

D. Substrate features of eastern Idaho and western Wyoming riparian community types . . . 72

E. Glossary . . . 77

F. Eastern Idaho-western Wyoming riparian community type field form . . . 78

LIST OF FIGURES:

Page

1. Area covered by this classification (shaded) showing counties and major towns 2
2. Area covered by this classification showing major mountain ranges and drainages 6
3. Picea/Cornus stolonifera c.t. 19
4. Picea/Galium triflorum c.t. 20
5. Populus angustifolia/Poa pratensis c.t. 22
6. Cornus stolonifera/Heracleum lanatum c.t. 24
7. Potentilla fruticosa/Deschampsia cespitosa c.t. 27
8. Artemisia cana/Festuca idahoensis c.t. 29
9. Salix geyeriana/Carex rostrata c.t. 31
10. Salix boothii/Carex rostrata c.t. 35
11. Salix boothii/Smilacina stellata c.t. 38
12. Salix wolfii/Carex aquatilis c.t. 41
13. Salix wolfii/Carex rostrata c.t. 42
14. Salix exigua/Equisetum arvense c.t. 46
15. Carex rostrata c.t. 50
16. Hypothesized successional relationships for major riparian community types of eastern Idaho and western Wyoming 59
17. Relationship with previous riparian community type classifications in Idaho and Wyoming 61

LIST OF TABLES:

1. Riparian community types of eastern Idaho and western Wyoming 11

Riparian Community Type Classification of Eastern Idaho - Western Wyoming

Andrew P. Youngblood
Wayne G. Padgett
Alma H. Winward

INTRODUCTION

The interface between aquatic and terrestrial ecosystems in the mountainous portions of eastern Idaho and western Wyoming forms an often narrow riparian zone. Until recently, structural, compositional, and functional components of riparian ecosystems within this zone received little consideration in ecosystem research and management. The riparian zone has often been overlooked, ignored, or considered a minor inclusion of the larger terrestrial or aquatic systems. Only in the last few decades has the significance of this riparian zone been realized. Current Forest Servce, U.S. Department of Agriculture, policy calls for management of riparian ecosystems with full recognition of their importance and unique values, as well as the classification, inventory and delineation of riparian ecosystems for land management planning (McGuire 1979; Peterson 1983).

Classification of riparian ecosystems in eastern Idaho and western Wyoming is complicated by varied geology and terrain, merging floristic regimes, contrasting successional relationships, and the dynamic nature of the riparian zone. However, classification of riparian ecosystems into community types, units of vegetation having similar floristic composition, does provide an integrated, ecosystem-management approach to resource categorization.

In 1979, the Intermountain Region of the Forest Service entered into a cooperative agreement with Utah State University, Logan, UT, to develop a riparian ecosystem classification for portions of western Wyoming. Fieldwork was concentrated in the Greys River drainage. Early results reported by Norton and others (1980, 1981) served as a model for later work by Tuhy and Jensen (1982) in central Idaho, and Mutz and Graham (1982) on the east side of the Wyoming Range. Followup efforts extended into eastern Idaho, with preliminary work by Mutz and Queiroz (1983) in the Centennial Mountains. Finally, the Intermountain Region of the Forest Service completed fieldwork throughout eastern Idaho and western Wyoming during 1983 an effort to unify previous classifications and incorporate new data. Data from (1) the Greys River studies (Norton and others 1980, 1981), (2) the Wyoming Range (Mutz and Graham 1982), (3) the Centennial Mountains (Mutz and Quieroz 1983), and (4) fieldwork during 1983 were combined and form the basis of this report.

The area covered by this new classification extends roughly from the Montana-Idaho state line and Spencer on U.S. Highway 91, through the Centennial Mountains of Idaho, south to Montpelier, and eastward to the east side of the Wyoming Range in west-central Wyoming (fig. 1). Lands within three National Forests (Targhee, Caribou, and Bridger-Teton) are featured, in addition to private and public lands adjacent to these National Forests. Some information may also be pertinent to riparian ecosystems outside the study area.

Objectives and Scope

The objectives of this study are:

1. To contribute to the broad regional classification program of the USDA Forest Service by developing a riparian community type classification for eastern Idaho and western Wyoming.

2. To describe the general geographic, topographic, edaphic, and floristic features of each community type.

3. To describe the successional trends for each community type, where possible.

4. To present information on resource values and management opportunities for each community type.

This classification is intended to cover all riparian ecosystems that occur repeatedly within the study area, and are large enough to be mapped at a reasonable scale for wildland management. In order to provide continuity with existing classifications of terrestrial ecosystems, this classification overlaps those of coniferous forest (Steele and others 1983), aspen (Youngblood and Mueggler 1981; Mueggler and Campbell 1982), sagebrush lands (Hironaka and others 1983; Bramble-Brodahl 1978), and tall forb communities (Gregory 1983).

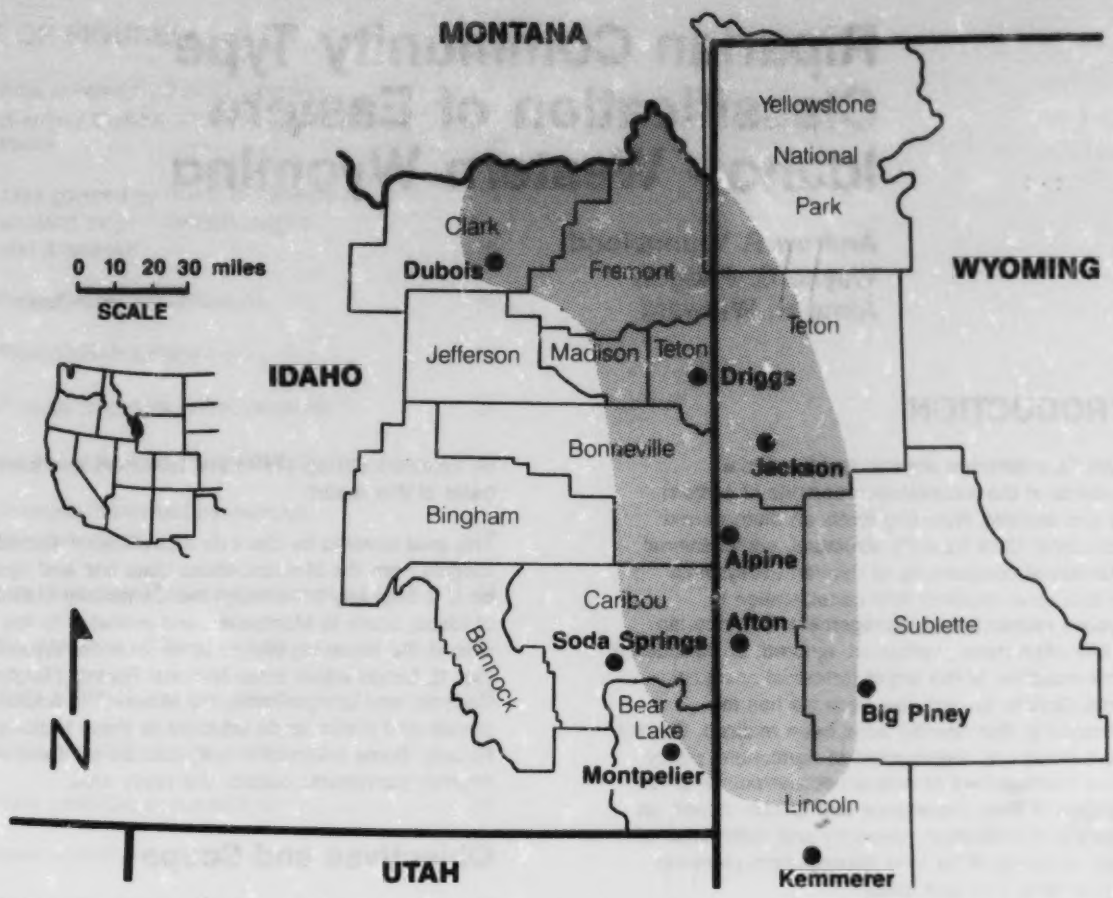


Figure 1.—Area covered by this classification (shaded) showing counties and major towns.

METHODS

Field Methods

This report is the result of four years of sampling within the riparian ecosystems. Although many individuals were involved, sampling procedures remained relatively constant. Stand selection was based on "subjective sampling without preconceived bias" as described by Mueller-Dombois and Ellenberg (1974). Reconnaissance of drainages was made prior to site selection. Notes were made on visually-dominant overstory and understory species, and locations were recorded for revisitation. Plots were selected that reflect the apparent range of environmental and successional conditions of the area and the homogeneity of vegetation, rather than the eventual placement of the stand within a classification system.

In all communities sampled, a 50 m^2 (538 $feet^2$) plot was used, most often with dimensions of 5 by 10 m (16 by 33 feet). Occasionally long stringer communities were sampled with a 2.5 by 20 m (8 by 66 feet) rectangular plot. The 50 m^2 plot size was considered adequate to include most species of a community, yet small enough for the sampler to see the entire plot. Each plot was located within a stand that was at least twice the area of the plot. This was done to avoid sampling ecotones between communities.

Canopy cover by species was ocularly estimated within each plot. In 1983, canopy cover was estimated to the nearest percent between 1 and 10 percent, and to the nearest 5 percent thereafter. Cover classes were used in all previous studies from which midpoints were calculated for later use in data analysis. Plants not identified in the field were collected for later identification in the office.

Annual production (standing crop) of total graminoid and total forb components was calculated prior to 1983 using a double-sampling weight estimate technique (Norton and others 1981). Weight estimates were coupled with actual clipping data and corrections applied for percent utilization. A regression analysis was used to correct for errors in estimated production.

A complete soil description was made for nearly all plots sampled using standard pedon description methods (USDA-SCS 1975) so that soils could be classified to family level. Soil pits and/or auger pits were dug to a depth of at least 1 m (39 inches) or to a restrictive layer of stone or cobble if less than 1 m. In some instances, soil samples were collected for later determination of dry colors. Depth to water table was noted when it occurred within the soil pit. Bedrock and surficial geology were determined using geologic maps (Love and others 1972; Richmond 1973; Prostka and Hackman 1974; Papeyan and others 1967; Staatz and Albee 1963; Jobin and Soister 1964; Vine 1959).

Other data collected for each plot included aspect, slope, position, configuration, disturbance, as well as notes on succession, relationship to upland habitat types, and adjacent riparian communities. Elevation was estimated to the nearest contour using USGS 7 1/2- or 15-minute topographic maps.

The data base for the development of the classification consisted of 469 sample plots. The geographic distribution of sample plots is presented in appendix A.

Office Methods

Development of the riparian community type classification followed the general procedures outlined below.

1. Specimens of plants were identified in the office or sent to various herbaria for verification. Field data forms were adjusted to reflect positive species identification.

2. Soils were classified to the family level using standard pedon description methods (USDA-SCS 1975). Available water capacity (inches of water/inch of soil) was estimated for the top 50 cm (20 inches) using guidelines developed by the U.S. Department of Agriculture, Soil Conservation Service (1983). A general characterization of geologic materials was determined from geologic maps.

3. All field data were computer coded for vegetation and environmental analyses. Preliminary association tables (Mueller-Dombois and Ellenberg 1974) were created using plot species and canopy coverage values. Association tables were rearranged several times to group stands with floristic similarities. Cluster analysis, using the Bray-Curtis similarity coefficient and unstandardized canopy coverage values with UPGMA clustering (Romesburg and Marshall 1984), along with detrended correspondence analysis (Hill and Gauch 1980) provided somewhat objective techniques for grouping. The final placement of each sample plot in a group was based on all three methods. Finally, constancy and average coverage tables were created for each group using selected representative species.

4. A dichotomous key to the preliminary types was developed based on species dominance. Vegetation and environmental characteristics for the types were identified and briefly described. The key was applied to all plots and necessary revisions were made to accomodate variations in these data. Less than 5 percent of the sample plots did not fit the resulting classification; these are briefly described in the Unclassified Stands section of the text.

5. A description was prepared for each riparian community type, including a map showing known locations. A general discussion of vegetation and physical environment, including soils, water table, and geologic materials, as well as the relationships among adjacent riparian community types and upland vegetation, was included.

This classification can be used as a foundation for the management of riparian zones located within the study area boundaries. Wildlife, livestock, and fire effects studies can benefit from the basic descriptions provided in this classification. Fish habitat and streambank stability and stabilization studies can also be aided. Specific management implications are discussed in the community type descriptions or in the discussion section of individual attributes of riparian community types following type descriptions.

Taxonomic Considerations

Most plants were identifiable to species during the fieldwork. Particularly difficult specimens were sent for verification to several herbaria in Utah, including the Intermountain Herbarium in Logan, the Forest Service Herbarium in Ogden, the University of Utah Garret Herbarium in Salt Lake City and the Brigham Young University Herbarium in Provo. Taxonomic nomenclature follows Dorn (1977) for the Salicaceae and Saxifragaceae families, Cronquist and others (1977) for Monocotyledons, and Hitchcock and Cronquist (1973) for all other taxa.

Inherent to all riparian ecosystem studies in the intermountain west is the difficulty in positive identification of *Salix* species. Because most species bloom early in the spring before leaves have fully expanded (precocious), and plants are dioecious, characteristics of male and female aments must be used for identification. Later, as leaves develop and the deciduous aments are lacking, overall growth form, leaf, and vegetative twig features become more important. Occasionally, hybrid clumps exhibit characteristics of several taxa. Because of com-

plexity in the genus and its widespread distribution, multiple names exist for many *Salix* species. We have used Dorn's (1977) treatment of *Salix boothii* for *S. myrtillifolia*; *S. lutea* for *S. rigida* (in part); *S. eastwoodiae* for *S. commutata*; and *S. planifolia* for *S. phylicifolia*.

Occasionally, some other species presented problems when only vegetative material was encountered. It was difficult to separate some *Aster* and *Erigeron* species when using mature floral parts. When no floral characteristics were available, specimens were grouped as *Aster* species. Vegetatively, *Valeriana dioica* and *V. occidentalis* are difficult to distinguish and were grouped as *Valeriana occidentalis*. *Rosa woodsii* and *R. nutkana* were similarly combined as *Rosa woodsii*. Several *Juncus* species have similar vegetative characteristics, but *J. balticus* appeared to be the most appropriate taxon because of its widespread occurrence. *Poa palustris* and *P. trivialis* are vegetatively and floristically very similar and were commonly found occupying the same sites. While both have been identified separately within the study area, they have been grouped in the classification because of this apparent ecological overlap. In the Greys River portion of the study area, Norton and others (1981) combined *Ribes lacustre* and *R. inerme* as the latter. Later reconnaissance indicated *Ribes lacustre* may be more prevalent, but the *R. inerme* epithet was retained within the data base. Therefore, our summary constancy-average cover tables may indicate slight exaggeration of this species' importance. Finally, distinguishing mature *Picea pungens* and *P. engelmannii* in the field is relatively simple, based on cone, twig, and bark characteristics. However, both species appear to have similar ecological amplitudes within the riparian ecosystems of our study area, and therefore have been grouped as *Picea* to simplify management considerations.

Specimens of *Artemisia cana* from throughout the study area were identified as subspecies *viscidula*. Also, all of our *Salix exigua* material was treated as subspecies *melanopsis*, according to Hitchcock and Cronquist (1973).

SYNECOLOGICAL PERSPECTIVE AND TERMINOLOGY

Community Type Concept

The community type is used as the basic unit of our riparian ecosystem classification. Recognition and naming of the community type is based on an initial ability to recognize communities. We consider communities as being somewhat homogeneous in all layers and differing from contiguous vegetation in either quantitative or qualitative characteristics (Daubenmire 1968). A community type is thus defined as an abstract grouping of all communities (stands) based upon floristic and structural similarities in both overstory and undergrowth layers.[1] Some of our riparian communities consist of only a single layer of vegetation; we consider this the overstory and ignore all references to additional strata. Naming the community type follows the frequently-used system of a binomial set with the dominant overstory species separated from the dominant or most diagnostic indicator of the undergrowth union by a slash (Mueller-Dombois and Ellenberg 1974). Thus, a community characterized by *Salix wolfii* in the overstory, and an undergrowth of *Carex aquatilis* and various mosses, is identified and written as belonging to the **Salix wolfii/Carex aquatilis community type.** In order to maintain continuity and simplicity, we have chosen not to use trinomial nomenclature. We have also grouped several species because of apparent similarity in ecological amplitude. Therefore, stands comprised of *Salix drummondiana* or *Salix boothii*, and all combinations of the two, are grouped together. We arbitrarily selected the species (*Salix boothii*, in this case) to use in the name.

Community types represent the existing structure and composition of communities, with no indication of successional status. They often describe conditions the resource manager may deal with on a day-by-day basis. The community type is a unit of vegetation that has no direct placement within a temporal setting. This is in contrast to the habitat type classification of land (site), in which time is held constant (Steele and others 1983). Habitat type classifications are based on the climax plant community, and describe the physical characteristics that allow that climax plant community to develop and persist. Our meager understanding of successional relationships within riparian ecosystems prevents us from distinguishing all climax plant communities and their necessary site characteristics. Indeed, the very concept of "climax" within the riparian zone may be tenuous (refer to Successional Relationships section, page 57). Our treatment involves distinguishing individual community types; successional trends connecting several community types may then be hypothesized.

Our classification is hierarchical. Community types may be aggregated upward into larger dominance groups that share a common physiognomy or overstory composition. This level of stratification may be useful for broad regional planning.

In developing the riparian community type classification, potentially important differential or diagnostic (indicator) species are evaluated in conjunction with stand characteristics and anticipated management strategies. Like most vegetation classifications, the variability within each community type must be carefully balanced against the variability between types. Many narrowly defined types may result in broad ecotones, while a few broadly defined types may reduce the ecotones. Our treatment is similar to previous work in other vegetation types (Mueggler and Campbell 1982) in that the accep-

[1]Users may find it helpful to consult a glossary of important terms found in Appendix E.

table level of within-type variability and the resulting ecotones are at least partially determined by the need for, and the projected use of, the final classification. For this reason, we have emphasized the structural characteristic of plant height and growth form such as tall shrub, low shrub, or forb. The written descriptions of our riparian community types portray modal conditions representative of the type. The key, however, is written in specific terms that narrow the ecotones for field identification and mapping.

Community types in general share certain traits with systematic taxonomy and ecology of plant species. Both community types and plant species have variable characteristics that complicate identification of the individual plant specimen or the specific community. Both are abstractions used to characterize most of the variation within a population of unknown size based on a limited sample or subset. Closely related community types, like plants, share many traits and are distinguished by relatively few and sometimes obscure features. Hybrid stands, like plants, are not uncommon, and are especially difficult to classify. When possible, we have allowed pertinent resource management practices to influence the treatment of these communities. Community types often have clear geographic distributions and variations that follow regional patterns of floristics and climate. Finally, endemic or disjunct distributions occur within community types as well as plant species.

Riparian Ecosystems and Communities

Within the mountainous portions of the western United States, the riparian zone is usually narrow, and often appears as lake or pond margins, seeps, bogs, or wet meadows when associated with a lentic (standing water) system, and river, stream, or spring edges near lotic (running water) systems. Riparian ecosystems have been defined in a number of ways, based on function (Thomas and others 1979a; Thomas and others 1979b), topography (Campbell 1970), and floristic composition (Pase and Layser 1977; Dick-Peddie and Hubbard 1977). We have chosen to define riparian ecosystems functionally as those areas of direct interaction between terrestrial (upland) and aquatic environments in a similar manner as Swanson and others (1982) and Meehan and others (1977), and yet have retained the characteristics of vegetation and soil as specific field identification features. Therefore, we have looked for plant communities consisting of species that require more moisture than normally found on contiguous uplands and sites having soils with evidence of at least periodic high water tables.

Riparian ecosystems have a number of ecologically significant attributes that cause them to be critically important for wildland management. They are often the biological and physical links between terrestrial and aquatic ecosystems. Nutrients and energy pass through the riparian zone in almost continuous interactions (Likens and Bormann 1974). Riparian ecosystems have been studied recently for their high animal species densities (Anderson and others 1977) and species diversity (Hubbard 1977; Stevens and others 1977) resulting from a "packing" or increase of water, food, cover, and available habitat in close proximity. More than 34 percent of Wyoming's terrestrial wildlife species are either largely or completely dependent on riparian ecosystems during one or more stage in their life cycle (Gerhart and Olsen 1982). Other wildlife species and livestock may utilize these ecosystems in disproportion to their availability because of higher productivity, palatability of forage and browse, shade, and proximity to other valuable habitat components. Riparian ecosystems also have been noted for their relatively high endemism (Hubbard 1977) and relatively large number of endangered species (Johnson and others 1977). Plant species diversity may be high resulting from a mix of facultative and obligate riparian species. Historically, riparian zones have been utilized as transportation corridors by man. Many of our National Forest roads in the west have been built on the relatively gentle terrain within the riparian zone, where visual resource values may exceed those of the uplands. Finally, riparian ecosystems may serve as a buffer between man's development and what may be his most vital natural resource—water (Odum 1979).

Riparian communities have a number of important and as yet unquantified relationships with aquatic ecosystems. Plant canopies influence water temperature and primary production in streams through shading, and contribute both coarse and fine organic material. Large stems and accumulations of coarse debris influence channel configuration through the creation of pools and riffles. Streambank stability can be influenced by density and size of roots. Rooted plants add to the hydraulic resistance of the channel, thereby influencing discharge rates of water and sediments. Riparian communities may also filter sediments produced upstream.

Unlike adjacent terrestrial communities, water is more readily available for plant uptake in riparian zones, and duration of this free, unbound water may influence community composition. Often the lack of oxygen rather than water may limit plant growth, and riparian species may exhibit special adaptations, such as aerenchyma cells, to overcome this stress (Torrey and Clarkson 1975, Esau 1977). Communities associated with streams and rivers may have to contend with frequent scouring or deposition resulting from flooding. Riparian communities found along seeps or springs that have constant high water tables may be limited by continual accumulation of organic material.

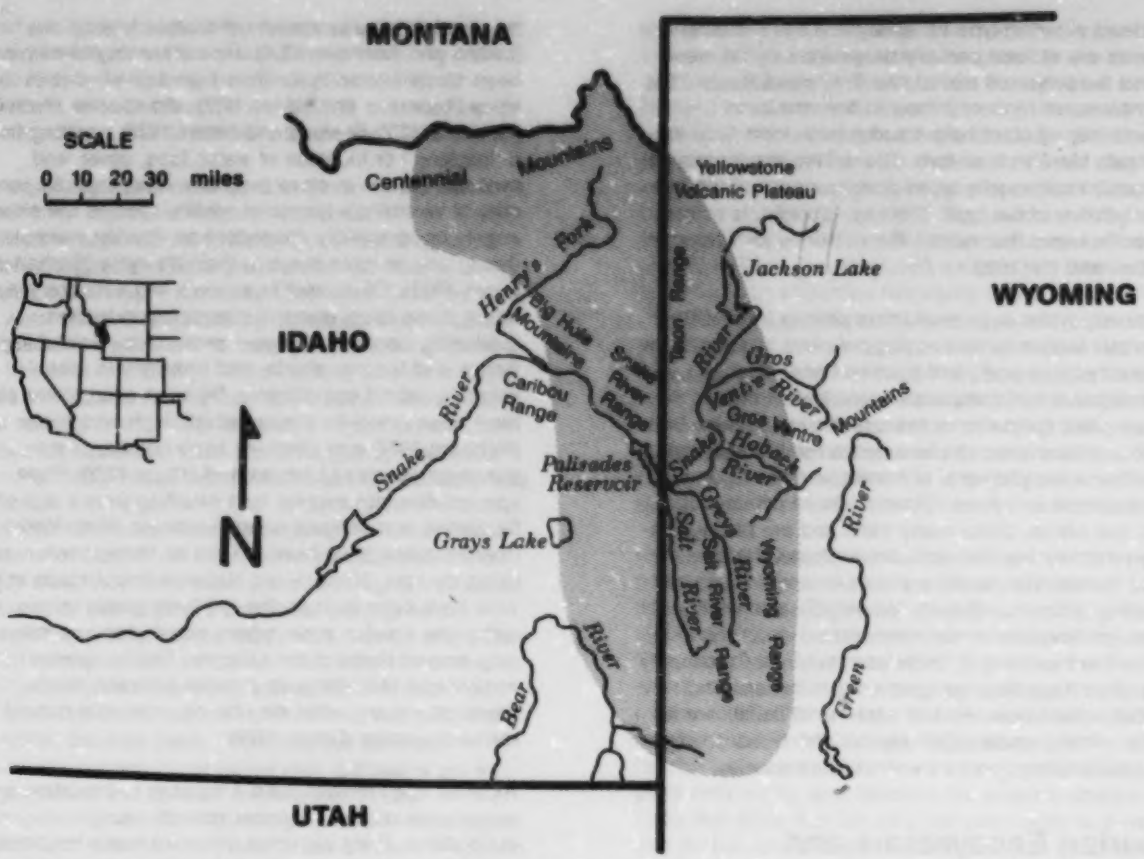


Figure 2.—Area covered by this classification showing major mountain ranges and drainages.

THE PHYSICAL SETTING

Physiography and Geology

Most of the study area is located in the Middle Rocky Mountain province as described by Fenneman (1931). The east-west oriented Centennial Range (fig. 2) is in the southernmost portion of the Northern Rocky Mountain province. The Big Hole, Snake River, Caribou, Salt River, and Wyoming Ranges are part of a series of parallel mountain ranges known collectively as the Wyomide Ranges. These are dominated by sedimentary close folds and thrust faults that have moved eastward along westward-dipping fault plains (Thornbury 1965). They form a somewhat arbitrary boundary with the more widely-spaced block mountains of the Great Basin province (Fenneman 1931). Other areas included in the study were the Gros Ventre and Teton Ranges and the Yellowstone Volcanic Plateau.

The Big Hole Range, which descends northward under the Snake River Lava Plains, is characterized by gentle, moderately high peaks, most between 2 130 and 2 740 m (7,000 and 9,000 feet) in elevation. Here, streams are relatively small with low gradients, and are in V- or notch-shaped drainages with narrow riparian zones. The Big Hole Range is drained either by the Snake River directly, or by Pine Creek and the Teton River, both Order 3 or 4 streams.

The Snake River Range is moderately high to high, with numerous peaks approaching 3 050 m (10,000 feet). Several Order 2 and 3 streams flow out of moderately steep canyons, while most valley bottoms are V- and notch-shaped with abrupt boundaries with the upland communities. Most streams drain into the Snake River, which flows on all but the northern boundary of this range. Streams in the north ultimately drain into the Teton River which feeds the Henrys Fork of the Snake River.

The Caribou Range is gently sloping and moderately high, characterized by large open slopes with only scattered timber. Watersheds are dendritic in shape, with V- to notch-shaped drainages, low sideslope gradients, and narrow riparian zones. In some of the major Order 2 and 3 drainages, (for example, McCoy Creek, Tincup Creek, Fall Creek, and Jacknife Creek) the riparian zone may be fairly wide, with the valley bottom sometimes exceeding 100 meters (330 feet) in width. The Caribou Range drains into the Salt and Snake Rivers to the east and northeast, and south into Tincup Creek, a tributary of the Salt River. To the west, the streams of this range drain into Grays Lake, which is ultimately drained by the Snake River.

The east slope of the Salt River Range and the west slope of the Wyoming Range are drained by the Greys River. Less than 5 percent of the upper (southern) portion of the Greys River is classified as Order 1 and 2, with a more or less dendritic drainage pattern. The majority of the Greys River has a trellis-like drainage pattern and is classified as Order 3 or 4. The lower nine miles of the River are classified as Order 5. A majority of the streams feeding the Greys River are Order 1 and 2. The Greys River is characterized as a V- or notch-shaped valley bottom in its lower and upper ends with moderately steep to steep sideslopes. Much of the river valley bottom, however, is notch-shaped to broad, with wide riparian zones bordered by moderately steep side slopes. The Salt River Range has many peaks over 3 050 m (10,000 feet) and V-shaped valley bottoms with steep to moderately steep sideslope gradients. Riparian zones are commonly narrow, with streams often adjacent to steep slopes dominated by upland vegetation.

The Wyoming Range, which is commonly divided into the Hoback Range on the north and the Wyoming Range on the south, is very similar on its west slope to the Salt River Range. The Wyoming Range is also moderately steep to steep. However, as the range descends eastward toward the Wyoming Basin, it opens up into low gradient slopes with broad valley bottoms. The east slope of the Wyoming Range drains predominantly into the Green River (part of the Colorado River system), while the southwestern slopes of the Wyoming and Salt River Ranges drain into the Bear River of the Great Basin province.

The Gros Ventre Range differs from the Wyomide Ranges in that it is an anticlinal mountain uplift as opposed to a thrust fault (Fenneman 1931). This range is topped by exposed granite and is surrounded by successive bands of sedimentary materials. It is characterized by V- and notch-shaped valley bottoms, with low to moderately steep sideslope gradients. The Gros Ventre River, an Order 3 and 4 river that drains the north slopes of this range, is in a broad valley bottom with riparian zones stretching nearly from one side to the other. Elevations are high, with many peaks between 3 050 m and 3 350 m (10,000 and 11,000 feet).

The Teton Range, with many peaks over 3 660 m (12,000 feet), is a nearly undeformed fault block uplifted on its steep east face exposing what was once deep lying granite (Fenneman 1931). The erosion of sedimentary rock in the Snake River valley to the east has aided in increasing the relative height of the Teton Range above the valley floor. The western slope of the range, dominated by sedimentary rock, is much less steep as it descends into the Teton Basin, which is continuous with the Snake River Lava Plain of Idaho. Both slopes of the Teton Range are cut by V-shaped valley bottoms with steep sideslope gradients and narrow riparian zones. Stream frequency is relatively low compared to the Wyomide Ranges to the south or the Yellowstone Volcanic Plateau to the north. Streams of this range drain into the Snake River to the east and the Teton River to the west.

The Yellowstone Volcanic Plateau is made up of rhyolites and welded tuffs, and is commonly divided into three parts; the western Madison Plateau, the northeastern Central Plateau, and the southern Pitchstone Plateau. The study area includes the southwest portion of the Pitchstone Plateau outside Yellowstone National Park, sections of which are overlain by aeolian silts and very fine sands. The plateau in this region is fairly level, with moderate to moderately high elevations, most below 2 440 m (8,000 feet). Most valley bottoms are broad or notch-shaped with relatively wide riparian zones and low sideslope gradients. This portion of the study area drains either directly into the Henrys Fork of the Snake River or into Falls River, which ultimately drains into the Henrys Fork.

The Centennial Range, located on the Montana-Idaho border, is a moderately high to high range, with most peaks at or near 2 740 m (9,000 feet) in elevation. This range is a complex of steep mountain summits with V- or notch-shaped valley bottoms and low to moderately steep sideslopes at mid elevations. Lower elevations are characterized by broad valley bottoms with low sideslope gradients. No large river systems are located in the Centennial Mountains, though a few Order 2 and 3 streams are present.

Soils

Although vegetation is often the easiest feature to recognize in riparian ecosystems, characteristics of the soil, particularly soil moisture, ultimately influence the plant species composition. Soils of riparian ecosystems are usually more diverse than those of adjacent uplands. Textural and particle-size classes, organic matter accumulation and decomposition, and water table depths may be strongly contrasting, often resulting from past changes in stream channel width and position. Differences are usually more gradual around lakes or pond margins. A seasonally high water table is required for soils to be considered riparian. This situation may range

from a few days annually to year-round. The depth at which soils are wet may also vary depending on both free water and capillary fringe. Where soils remain saturated for extended periods of time, biological activity (nutrient cycling and oxidation-reduction reactions) may be functioning in an anaerobic state. These gleyed soils, characterized by the presence of ferrous iron and neutral gray colors, often change color rapidly when exposed to oxygen. When water tables fluctuate more frequently between alternating wet-dry periods, oxidation and reduction reactions may produce mottling with high chroma.

Soil textural and particle-size classes are often indicative of the type and degree of fluvial activity that has taken place. Surface horizons usually grade from coarse to fine away from previous channel axes. Buried horizons that are strongly contrasting may indicate channel positions or stream flows different from current conditions. Structural development also is helpful in hypothesizing the degree of in-situ pedogenesis.

Organic matter accumulation and decomposition proceed rapidly near the soil surface within the riparian ecosystem. Material is produced on-site or may be transported by fluvial processes. However, under anaerobic conditions, decomposition rates are almost negligible, and thick organic matter layers may develop over time. Recent fluvial deposition usually results in soils with irregular decreases in organic matter with depth. This contrasts with most upland soils containing a regular decrease with depth.

Sampled riparian soils within the study area belong to five orders, based on the presence or absence of diagnostic horizons or broad features characteristic of the formative processes. Nine suborders are recognized, based on major moisture or temperature regimes for the order. Great groups also involve differences of moisture and temperature, but are based on soil properties rather than processes. Subgroups are named after characteristics that modify the previously-named features. Finally, the family taxa are used to group soils having similar physical and chemical properties that affect their responses to management.

Mollisols are the most frequently encountered soils within the riparian zones of our study area. This order includes those soils having a dark brown to black surface horizon (the mollic epipedon) that is relatively thick, has a high base saturation, and usually well developed structure. The mollic epipedon is primarily the result of underground decomposition of organic residues in the presence of bivalent cations such as calcium. These soils have formed under relatively stable conditions and have supported dense vegetation that usually includes graminoids. Sites are commonly found on alluvial terraces, broad valley bottoms, and gentle toeslopes away from the disruptive fluvial action of active streams. At the suborder level, Mollisols that are usually saturated, with little or no free dissolved oxygen for prolonged periods during the growing season (a reducing regime) have an aquic moisture regime, and are classified as Aquolls. Mean annual soil temperatures in our study area are between 0 and 8 °C (32 and 47 °F) (Jensen 1984); therefore, our Aquolls have cryic temperature regimes and belong to the Cryaquoll great group. Subgroups are differentiated into Typic, Argic, Histic, or Cumulic, based upon the presence or absence of an argillic horizon, histic epipedon, or mollic epipedon greater than 50 cm (20 inches) thick. Mollisols that are not saturated, have chroma more than 2, and lack distinct or prominent mottles, belong to the Boroll suborder. These soils all have a mean annual soil temperature lower than 8 °C (47 °F) (Jensen 1984), and are thus classified as Cryoborolls. At the subgroup level, our soils belonged to the Typic, Aquic, Argic, Pachic, Calcic, Cumulic, or Pachic taxa, depending upon the presence or absence of mottles in the lower horizon, presence of an argillic or calcic horizon, and thickness of the mollic horizon. These Cryoborolls often occur in the driest extremes of the riparian zone, and may extend up and outward, supporting non-riparian vegetation.

Histosols are soils that contain a surface horizon of organic matter that is usually at least 40 cm (16 inches) thick. Suborders are distinguished by the degree of decomposition of organic material and the presence of *Sphagnum* fibers. Most Histosols in our study area are hemic, indicating that approximately one half of the material has decomposed enough that the botanic origin can not be determined; or fibric, with only partially decomposed wood and remains of herbaceous plants. These soils are usually permanently saturated with water, and have developed with cryic temperatures and very little free oxygen, resulting in slow decomposition. Sites conducive to such development include permanent bogs and seeps, small drainages influenced by beaver dams, and broad valley bottoms such as those underlaid by rhyolite on the Pitchstone Plateau outside Yellowstone National Park.

Inceptisols found in our study area are soils that lack the mollic epipedon, and have high available water throughout the growing season, textures finer than loamy sand, and altered horizons that have lost bases but retain some weatherable minerals. The aquic moisture regime was used to place soils into the Aquept suborder. Two great groups occur, including the cool Cryaquepts and the sodic or saline Haplaquepts. These were encountered very infrequently throughout the study area.

Entisols in our study area are those soils that have little or no evidence of pedogenic horizons, normally, as a result of recent deposition by fluvial action. All Entisols encountered during this study belong to the cryic temperature regime. Where the slopes are less than 25 percent and organic-carbon content decreases irregularly with depth, soils are classified as Fluvents. They may be frequently flooded, or have great fluctuations in the

water table. Depth of ground water and the presence of mottles of low chroma distinguish the Aquic or Typic subgroup of the Cryofluvents. Aquents are soils that are saturated for a longer period and are commonly bluish or gray and mottled. A single Fluvaquent, with extensive stratification, was sampled where changing currents and river channels deposited different size particles. The more commonly encountered Typic subgroup of Cryaquents occur throughout the study area on a wide variety of sites, including broad valley bottoms that flood occasionally, gentle toe slopes and terraces in close proximity to high gradient streams, and narrow V-shaped drainages containing Order 1 or 2 streams. A few Cryorthants were noted; these drier soils usually support conifer stands.

A final order, Alfisols, includes a variety of infrequently encountered soils that have translocated clays and lack the mollic epipedon. They are somewhat intermediate in development between the young Entisols or Inceptisols and the well-developed Mollisols.

The level of soil classification used throughout our work has been family. Family differentiae for mineral soils are based primarily on particle size. Organic soils within the Histosol order are differentiated by particle size and mineral soil depth.

Climate

Steele and others (1983) summarized the climatic features of the study area, although their work emphasized the major abiotic environmental features of upland sites supporting coniferous forests. Because most riparian communities are rarely affected by meterological events that may determine upland communities, such as pattern and amounts of precipitation, relationships with adjacent upland communities are difficult to establish. Likewise, most weather station data are of limited value. However, precipitation pattern may influence some seedling establishment, especially along small drainages. Baker's (1944) review of mountain climates, and weather data from selected recording stations throughout the study area, indicated relatively uniform or even monthly precipitation, with total annual accumulations ranging between 15 and 30 cm (6 and 12 inches). Snowfall accumulations range from 130 to 500 cm (50 to 200 inches) for elevations from 1 830 to 2 440 m (6,000 to 8,000 feet).

Temperature gradients between riparian communities and upland sites are often sharp. Many of our riparian ecosystems may be influenced by lower temperatures because of cold air drainage down slopes. Where this cold air accumulates, such as on broad valley bottoms and on terraces, frost is possible throughout the growing season. In general, the mean July temperature within the study area at 2 440 m (8,000 feet) is 12 °C (52 °F), while the mean January temperature at the same elevation may be -12 °C (10 °F). Sites immediately adjacent to beaver ponds or oxbow lakes may have temperatures somewhat ameliorated by standing water.

Upland Vegetation

Although riparian zones are normally floristically different from adjacent upland or terrestrial plant communities, many individual species do overlap. Knowledge of the adjacent plant communities can often help explain relationships within the riparian ecosystem. The user is, therefore, encouraged to consult similar classifications for pertinent vegetation types. *Populus tremuloides* stands in Idaho have been described by Mueggler and Campbell (1982) and in Wyoming by Youngblood and Mueggler (1981). A number of their community types often occur adjacent to our riparian community types. Sagebrush-dominated lands have been classified into habitat types by Bramble-Brodahl (1978) and Hironaka and others (1983). Overlap exists where sites support *Artemisia cana*. Forb-dominated communities in western Wyoming, as described by Gregory (1983), often abut higher elevation riparian communities and in some situations may be classified as riparian. Finally, upland sites potentially supporting conifers have been described by Steele and others (1983). Riparian communities often are in close proximity to habitat types named after either *Abies lasiocarpa* or *Pseudotsuga menziesii*. Overlap occurs where *Picea pungens* or *Picea engelmannii* is found along streambanks or seeps.

THE RIPARIAN COMMUNITY TYPE CLASSIFICATION

Fifty-two riparian community types, within eight major physiognomic groups, have been defined for the eastern Idaho and western Wyoming study area. This large number of types reflects the environmental diversity resulting from topography, climate, geology, and converging floristic regimes, and also the influences of differing perturbations and successional processes. All community types are listed by abbreviation and full scientific name in table 1. The term community type is used so frequently that the abbreviation c.t. is used for convenience. Frequent use of c.t. names throughout the text also necessitates abbreviations. The commonly accepted practice of using the first two letters of the genus and species involved as the taxonomic name is followed throughout the text. For example, **Salix boothii/Carex rostrata** is reduced to **SABO/CARO**. Common names are not used within the text to avoid confusion resulting from variations due to local practices or customs.

The classification is presented in the following order:

1. Key to dominance groups and community types. The key provides an orderly process for first determining the major physiognomic or dominance group, and then the appropriate community type.

2. Dominance groups. Common attributes of community types having similar overstories are summarized at the group level. This provides a general overview of conditions and characteristics for the community types that follow.

3. Community type descriptions. Detailed type descriptions summarize the distribution, physical environment, relative abundance of characteristic vegetation, and general management implications.

Arrangement of c.t.'s within the key often proceeds from the most extreme site conditions to the most general, e.g., the more moist types are usually encountered before drier types. Likewise, undisturbed types are followed by disturbance types. Understanding this hypothesized ordination is often useful when using the classification. The general distribution of c.t.'s, according to our sample plots, is usually illustrated with dot maps in addition to being summarized in the text. Appendix A lists the total number of sample points by c.t. and general vicinity. Relative abundance of a c.t. within the study area is indicated by the terms incidental, minor, or major. An incidental c.t. rarely occurs in more than one general vicinity such as a major drainage but may extend into our study area from elsewhere (therefore no dot map). A minor c.t. may occur sporadically throughout the study area, but seldom describes a large unit of vegetation. Minor c.t.'s, however, may be significant as elements of diversity. A major c.t. describes extensive acreages of vegetation in at least some drainages. Arrows on some maps indicate known occurrences of the same c.t. beyond the study area.

Users should note that the key is not the classification, but rather a tool to assist in using the classification. We have attempted to construct a key with very specific terms that will narrow the ecotones for field identification. In contrast, the type descriptions are generalized to portray modal conditions. In any classification effort, and especially in dynamic ecosystems such as riparian zones, variation is expected within all classified types. The user is cautioned to validate the determination made using the key by checking the written descriptions and supporting appendixes BEFORE leaving the stand or plot.

Table 1.—Riparian community types of eastern Idaho and western Wyoming

Abbreviation	Community Type
	Tree-dominated community types
PICEA/EQAR c.t.	Picea/Equisetum arvense c.t.
PICEA/COST c.t.	Picea/Cornus stolonifera c.t.
PICEA/CACA c.t.	Picea/Calamagrostis canadensis c.t.
PICEA/GATR c.t.	Picea/Galium triflorum c.t.
POAN/COST c.t.	Populus angustifolia/Cornus stolonifera c.t.
POAN/POPR c.t.	Populus angustifolia/Poa pratensis c.t.
	Mixed shrub-dominated community types
ALIN/RIHU c.t.	Alnus incana/Ribes hudsonianum c.t.
COST/HELA c.t.	Cornus stolonifera/Heracleum lanatum c.t.
COST/GATR c.t.	Cornus stolonifera/Galium triflorum c.t.
RHAL c.t.	Rhamnus alnifolia c.t.
POFR/DECE c.t.	Potentilla fruticosa/Deschampsia cespitosa c.t.
POFR/FEID c.t.	Potentilla fruticosa/Festuca idahoensis c.t.
POFR/POPR c.t.	Potentilla fruticosa/Poa pratensis c.t.
ARCA/FEID c.t.	Artemisia cana/Festuca idahoensis c.t.
ARCA/POPR c.t.	Artemisia cana/Poa pratensis c.t.
	Salix geyeriana-dominated community types
SAGE/POPA c.t.	Salix geyeriana/Poa palustris c.t.
SAGE/CARO c.t.	Salix geyeriana/Carex rostrata c.t.
SAGE/CACA c.t.	Salix geyeriana/Calamagrostis canadensis c.t.
SAGE/MF c.t.	Salix geyeriana/Mesic Forb c.t.
SAGE/POPR c.t.	Salix geyeriana/Poa pratensis c.t.
	Salix boothii-dominated community types
SABO/CARO c.t.	Salix boothii/Carex rostrata c.t.
SABO/CANE c.t.	Salix boothii/Carex nebrascensis c.t.
SABO/CACA c.t.	Salix boothii/Calamagrostis canadensis c.t.
SABO/EQAR c.t.	Salix boothii/Equisetum arvense c.t.
SABO/POPA c.t.	Salix boothii/Poa palustris c.t.
SABO/SMST c.t.	Salix boothii/Smilacina stellata c.t.
SABO/POPR c.t.	Salix boothii/Poa pratensis c.t.
	Salix wolfii-dominated community types
SAWO/CAAQ c.t.	Salix wolfii/Carex aquatilis c.t.
SAWO/CARO c.t.	Salix wolfii/Carex rostrata c.t.
SAWO/CACA c.t.	Salix wolfii/Calamagrostis canadensis c.t.
SAWO/CANE c.t.	Salix wolfii/Carex nebrascensis c.t.
SAWO/DECE c.t.	Salix wolfii/Deschampsia cespitosa c.t.
SAWO/POPA c.t.	Salix wolfii/Poa palustris c.t.
SAWO/MF c.t.	Salix wolfii/Mesic Forb c.t.
	Other *Salix*-dominated community types
SAEX/EQAR c.t.	Salix exigua/Equisetum arvense c.t.
SAEX/POPR c.t.	Salix exigua/Poa pratensis c.t.
SALU c.t.	Salix lutea c.t.
SAPL c.t.	Salix planifolia c.t.
SAEA c.t.	Salix eastwoodiae c.t.
	Graminoid-dominated community types
CAMI c.t.	Carex microptera c.t.
CASI c.t.	Carex simulata c.t.
CARO c.t.	Carex rostrata c.t.
CAAQ c.t.	Carex aquatilis c.t.
CANE c.t.	Carex nebrascensis c.t.
CAREX c.t.	Miscellaneous Carex c.t.'s
JUBA c.t.	Juncus balticus c.t.
DECE c.t.	Deschampsia cespitosa c.t.
POPA c.t.	Poa palustris c.t.
POPR c.t.	Poa pratensis c.t.
	Forb-dominated community types
VECA c.t.	Veratrum californicum c.t.
MECI c.t.	Mertensia ciliata c.t.
MFM c.t.	Mesic Forb Meadow c.t.

KEY TO DOMINANCE GROUPS AND COMMUNITY TYPES

READ THESE INSTRUCTIONS FIRST:

1. Use this key for riparian communities within or immediately adjacent to the Targhee, Caribou, or Bridger-Teton National Forests.

2. Locate 50 m^2 sample plot in representative portion of the stand.

3. Accurately identify and record canopy coverages for all indicator species as listed on the field form (appendix F).

4. Check plot data in the field to verify that the plot is representative of the stand as a whole, using recorded canopy coverage values. If not representative, locate another plot.

5. While in the plot, identify the correct Overstory Dominance Group. In general, a species or group of species will appear to dominate the community if canopy coverage is about 25 percent.

6. Within the appropriate Group, key to community type by following the key literally. Verify the identification by comparing the stand's composition and site characteristics with the written descriptions.

7. Remember, the key is NOT the classification! Validate the determination made using the key by checking the written description and appendix B

Key to Overstory Dominance Groups

1. Trees dominating overstory with at least 25 percent cover ..... GROUP A

1. Trees not dominating overstory 2

    2. Shrubs dominating overstory with at least 25 percent cover 3

    2. Shrubs not dominating overstory 7

3. *Salix* species dominating overstory 4

3. *Salix* species not dominating overstory ..... GROUP B

    4. *Salix geyeriana* dominating overstory with cover usually exceeding 25 percent ..... GROUP C

    4. *Salix geyeriana* not dominating overstory 5

5. *Salix boothii* or *Salix drummondiana* dominating overstory with cover of one or both species usually exceeding 25 percent ..... GROUP D

5. *Salix boothii* or *Salix drummondiana* not dominating overstory 6

    6. *Salix wolfii* or *Betula glandulosa* dominating overstory with cover usually exceeding 25 percent, either collectively or separately ..... GROUP E

    6. Not as above. Other *Salix* species dominating overstory ..... GROUP F

7. Graminoids dominating the community ..... GROUP G

7. Graminoids not dominating the community. Forbs dominant lifeform ..... GROUP H

GROUP A. Key to Tree-Dominated Community Types

1. *Picea engelmannii, Picea pungens, Abies lasiocarpa*, or *Pinus contorta* dominating the overstory with at least 25 percent cover, either separately or collectively 2

1. Not as above. *Populus angustifolia* dominating the overstory 5

   2. *Equisetum arvense* at least 25 percent cover ..... **Picea/Equisetum arvense c.t.*** (p. 18)

   2. *Equisetum arvense* less than 25 percent cover 3

3. *Cornus stolonifera* at least 25 percent cover ..... **Picea/Cornus stolonifera c.t.** (p. 18)

3. *Cornus stolonifera* less than 25 percent cover 4

   4. *Calamagrostis canadensis* at least 25 percent cover ..... **Picea/Calamagrostis canadensis c.t.*** (p. 20)

   4. *Calamagrostis canadensis* less than 25 percent cover. *Actaea rubra, Galium triflorum, Senecio triangularis, Smilacina stellata* or *Thalictrum occidentale* at least 5 percent cover either separately or collectively .. **Picea/Galium triflorum c.t.** (p. 20)

5. *Cornus stolonifera* at least 25 percent cover ..... **Populus angustifolia/Cornus stolonifera c.t.*** (p. 21)

5. Not as above. *Poa pratensis* at least 25 percent cover ..... **Populus angustifolia/Poa pratensis c.t.** (p. 22)

GROUP B. Key to Mixed Shrub-Dominated Community Types

1. *Cornus stolonifera, Alnus incana*, or *Alnus sinuata* at least 25 percent cover, either separately or collectively 2

1. Not as above 4

   2. *Alnus* or *Ribes hudsonianum* at least 25 percent cover ..... **Alnus incana/Ribes hudsonianum c.t.** (p. 23)

   2. *Alnus* or *Ribes hudsonianum* less than 25 percent cover 3

3. *Heracleum lanatum* at least 5 percent cover ..... **Cornus stolonifera/Heracleum lanatum c.t.** (p. 24)

3. Not as above. *Smilacina stellata* and *Galium triflorum* usually present ..... **Cornus stolonifera/Galium triflorum c.t.** (p. 25)

   4. *Rhamnus alnifolia* at least 50 percent cover ..... **Rhamnus alnifolia c.t.*** (p. 26)

   4. *Rhamnus alnifolia* less than 50 percent cover 5

5. *Potentilla fruticosa* at least 5 percent cover 6

5. *Artemisia cana* at least 5 percent cover 8

6. *Deschampsia cespitosa* at least 5 percent cover ..... **Potentilla fruticosa/Deschampsia cespitosa c.t.** (p. 26)

6. *Deschampsia cespitosa* less than 5 percent cover 7

7. *Festuca idahoensis* at least 5 percent cover ..... **Potentilla fruticosa/Festuca idahoensis c.t.*** (p. 27)

7. Not as above. *Poa pratensis* at least 5 percent cover ..... **Potentilla fruticosa/Poa pratensis c.t.*** (p. 28)

8. *Festuca idahoensis* at least 5 percent cover ..... **Artemisia cana/Festuca idahoensis c.t.** (p. 28)

8. Not as above. *Poa pratensis* usually present ..... **Artemisia cana/Poa pratensis c.t.*** (p. 30)

GROUP C. Key to *Salix geyeriana*-Dominated Community Types

1. *Carex rostrata* or *Carex aquatilis* at least 25 percent cover either separately or collectively ..... **Salix geyeriana/Carex rostrata c.t.** (p. 30)

1. Not as above 2

2. *Poa palustris* or *Poa trivialis* at least 25 percent cover ..... **Salix geyeriana/Poa palustris c.t.** (p. 31)

2. Not as above 2

3. *Calamagrostis canadensis* at least 25 percent cover ..... **Salix geyeriana/Calamagrostis canadensis c.t.** (p. 32)

3. *Calamagrostis canadensis* less than 25 percent cover 4

4. *Heracleum lanatum, Thalictrum occidentale*, or *Valeriana occidentalis* at least 5 percent cover either separately or collectively ..... **Salix geyeriana/Mesic Forb c.t.*** (p. 33)

4. Not as above. *Poa pratensis* usually present ..... **Salix geyeriana/Poa pratensis c.t.** (p. 33)

GROUP D. Key to *Salix boothii*-Dominated Community Types

1. *Carex rostrata* or *Carex aquatilis* at least 25 percent cover either separately or collectively ..... **Salix boothii/Carex rostrata c.t.** (p. 34)

1. Not as above 2

2. *Carex nebrascensis* at least 25 percent cover ..... **Salix boothii/Carex nebrascensis c.t.** (p. 35)

2. *Carex nebrascensis* less than 25 percent cover 3

3. *Calamagrostis canadensis* at least 25 percent cover ..... **Salix boothii/Calamagrostis canadensis c.t.** (p. 36)

3. *Calamagrostis canadensis* less than 25 percent cover 4

4. *Equisetum arvense* at least 25 percent cover or dominant understory herb or *Saxifraga odontoloma* at least 5 percent cover ..... **Salix boothii/Equisetum arvense c.t.** (p. 36)

4. Not as above 5

5. *Poa palustris* or *Poa trivialis* at least 25 percent cover ..... **Salix boothii/Poa palustris c.t.** (p. 37)

5. Not as above 6

6. Undergrowth clearly dominated by a single species or a mixture of forbs such as *Heracleum lanatum, Smilacina stellata,* or *Mertensia ciliata. Poa pratensis,* if present, contributes little canopy cover ..... **Salix boothii/Smilacina stellata c.t.** (p. 37)

6. Not as above. Undergrowth conspicuously dominated by graminoids such as *Poa pratensis* ..... **Salix boothii/Poa pratensis c.t.** (p. 39)

GROUP E. Key to *Salix wolfii*-Dominated Community Types

1. *Carex aquatilis* at least 25 percent cover or *Pedicularis groenlandica* at least a codominant ..... **Salix wolfii/Carex aquatilis c.t.** (p. 40)

1. Not as above 2

2. *Carex rostrata* at least 25 percent cover ..... **Salix wolfii/Carex rostrata c.t.** (p. 41)

2. *Carex rostrata* less than 25 percent cover 3

3. *Calamagrostis canadensis* at least 25 percent cover ..... **Salix wolfii/Calamagrostis canadensis c.t.*** (p. 43)

3. *Calamagrostis canadensis* less than 25 percent cover 4

4. *Carex nebrascensis* or *Carex simulata* at least 5 percent cover ..... **Salix wolfii/Carex nebrasconsis c.t.*** (p. 43)

4. Not as above 5

5. *Deschampsia cespitosa* at least 5 percent cover ..... **Salix wolfii/Deschampsia cespitosa c.t.*** (p. 43)

5. *Deschampsia cespitosa* less than 5 percent cover 6

6. *Poa palustris* or *Poa trivialis* at least 5 percent cover ..... **Salix wolfii/Poa palustris c.t.*** (p. 44)

6. Not as above. *Aster foliaceus* or *Helenium hoopesii* usually present .. **Salix wolfii/Mesic Forb c.t.** (p. 44)

GROUP F. Key to Other *Salix*-Dominated Community Types

1. *Salix exigua* at least 25 percent cover 2

1. *Salix exigua* less than 25 percent cover 3

2. *Equisetum arvense* at least 5 percent cover or *Calamagrostis canadensis* at least 25 percent cover ..... **Salix exigua/Equisetum arvense c.t.** (p. 45)

2. Not as above. *Poa pratensis* usually present ..... **Salix exigua/Poa pratensis c.t.** (p. 46)

3. *Salix lutea* at least 25 percent cover ..... **Salix lutea c.t.*** (p. 47)

3. *Salix lutea* less than 25 percent cover 4

4. *Salix planifolia* at least 25 percent cover ..... **Salix planifolia c.t.*** (p. 47)

4. Not as above. *Salix eastwoodiae* at least 25 percent cover ..... **Salix eastwoodiae c.t.*** (p. 48)

GROUP G. Key to *Graminoid*-Dominated Community Types

1. *Carex* species dominating the overstory 2

1. Not as above, other graminoids dominating the overstory 7

2. *Carex microptera* at least 25 percent cover or dominant overstory species ..... **Carex microptera c.t.** (p. 48)

2. Not as above 3

3. *Carex simulata* at least 25 percent cover or dominant overstory species ... **Carex simulata c.t.*** (p. 49)

3. Not as above 4

4. *Carex rostrata* at least 50 percent cover or dominating the overstory . **Carex rostrata c.t.** (p. 49)

4. Not as above 5

5. *Carex aquatilis* at least 25 percent cover or dominating the overstory ..... **Carex aquatilis c.t.*** (p. 51)

5. Not as above 6

6. *Carex nebrascensis* at least 25 percent cover or dominating the overstory ..... **Carex nebrascensis c.t.*** (p. 52)

6. Not as above. Other Carices dominating the overstory ..... **Miscellaneous Carex c.t.'s*** (p. 52)

7. *Juncus balticus* at least 25 percent cover or dominating the overstory ..... **Juncus balticus c.t.*** (p. 52)

7. Not as above. Grasses dominating the overstory 8

8. *Deschampsia cespitosa* at least 25 percent cover or the dominant graminoid in the overstory ..... **Deschampsia cespitosa c.t.** (p. 53)

8. Not as above 9

9. *Poa palustris* or *Poa trivialis* at least 25 percent cover ..... **Poa palustris c.t.*** (p. 54)

9. Not as above. *Poa pratensis* usually present ..... **Poa pratensis c.t.** (p. 54)

GROUP H. Key to Forb-Dominated Community Types

1. *Veratrum californicum* at least 50 percent cover ..... **Veratrum californicum c.t.*** (p. 54)

1. *Veratrum californicum* less than 50 percent cover 2

2. *Mertensia ciliata* or *Senecio triangularis* at least 25 percent cover either separately or collectively ..... **Mertensia ciliata c.t.*** (p. 55)

2. Not as above, *Aster foliaceus* or *Helenium hoopesii* usually present .. **Mesic Forb Meadow c.t.*** (p. 55)

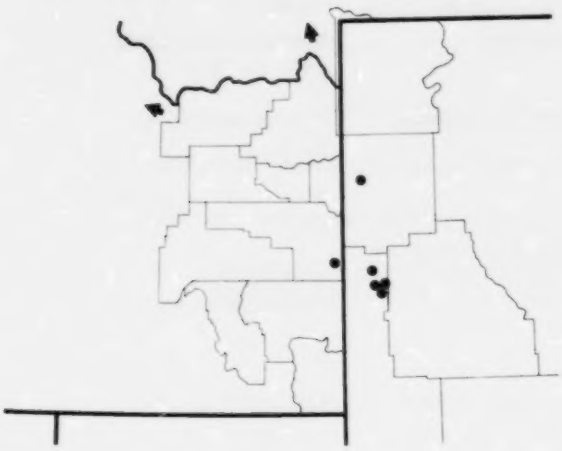
*Incidental or minor community type, may be omitted from other charts or tables.

DESCRIPTION OF DOMINANCE GROUPS AND RIPARIAN COMMUNITY TYPES

Tree-Dominated Community Types

A number of c.t.'s are dominated by trees such as *Abies lasiocarpa, Picea pungens, Picea engelmannii, Pinus contorta*, or *Populus angustifolia*. These species often occur as scattered individuals of low stature and canopy cover in a wide variety of other c.t.'s with little differences in associated species. However, when canopy cover exceeds 25 percent, we believe significant structural differences warrant differentiation. In addition, establishment of a mature coniferous overstory is often indicative of successional trends approaching a stable sere. Thus, the **Picea/Equisetum arvense** and **Picea/Galium triflorum c.t.'s** often indicate climax vegetation within the previously documented habitat types described by Steele and others (1983). In most cases, *Populus angustifolia* c.t.'s represent intermediate stages between nonforest c.t.'s and more mature vegetation types dominated by *Picea*. As a result of the greatly increased structural diversity, these c.t.'s dominated by trees may be very important as wildlife habitat, especially for avian species. The **Picea/Equisetum arvense** and **Picea/Galium triflorum c.t.'s** provide habitat used by a number of birds including mountain chickadee, ruby-crowned kinglet, yellow-rumped warbler, western tanager, evening grosbeak, and pine siskin (Douglas and Ratti 1984).

Picea/Equisetum arvense c.t.
(PICEA/EQAR)



DISTRIBUTION.—PICEA/EQAR is a widely scattered minor c.t. that occurs throughout the study area. It also extends eastward along the Wind River Range and northwestward into central Idaho and Montana. Our stands were found most often in the lower portion of the Greys River drainage and along Palisades Reservoir from 1 830 to 2 130 m (6,000 to 7,000 feet) in elevation. This c.t. is usually restricted to gentle toeslopes, seeps, and stream terraces with northerly aspects that have continually saturated soils. Boundaries with adjacent types are often distinct. Upland vegetation is usually dominated by *Abies lasiocarpa* or *Pseudotsuga menziesii*, while other riparian types include the **Carex rostrata c.t.** or those dominated by *Salix exigua*.

VEGETATION.—Either *Picea pungens* or *Picea engelmannii* dominate a normally dense overstory. *Abies lasiocarpa* and *Pinus contorta* are occasionally present on drier microsites such as windthrow hummocks. Shrub cover is usually negligible, with only *Lonicera involucrata*, *Rosa* spp., and *Amelanchier alnifolia* occasionally present. These species normally indicate drier ecotonal or microsite conditions. A dense carpet of the diagnostic herb *Equisetum arvense* characterizes the undergrowth. Other associates include *Carex aquatilis*, *Elymus glaucus*, *Geranium richardsonii*, *Senecio triangularis*, and *Smilacina stellata*.

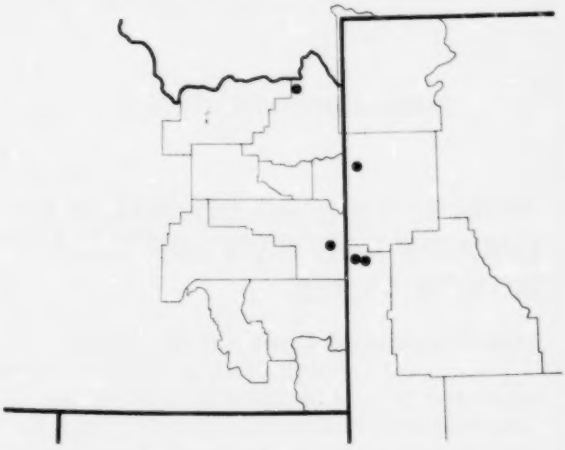
SOILS.—Soils are usually derived from weathered Cretaceous sediments. Our samples all have an aquic moisture regime and are predominately Cryaquents or Cryaquolls. Textures are highly variable. Available water capacity is moderate. Water tables are usually less than 50 cm (19.7 inches) deep.

SUCCESSION/MANAGEMENT.—PICEA/EQAR is considered a stable and climax c.t., and thus represents the climax sere within the **Picea engelmannii/ Equisetum arvense habitat type** described by Steele and others (1983). The **Populus tremuloides/ Equisetum arvense c.t.** described by Youngblood and Mueggler (1981) is considered a localized variant and a seral stage of the habitat type.

Timber productivity and silvicultural implications are best described by Steele and others (1983). We support their restrictions on any surface-disturbing activity. Limited data suggest undergrowth production may be high (appendix C), but these stands have little or no value for domestic livestock other than shading. Soils are relatively sensitive to disturbance and can easily be churned into muck by agitation of the surface. *Equisetum arvense* is of documented importance for grizzly bear (Knight and Blanchard 1983). In summer, black bear use these sites for wallows. Other wildlife, especially small mammals and avian species, may make high use of these sites because of their structural diversity. Big game may also use this c.t., especially during the rutting season.

OTHER STUDIES.—Sites supporting the **PICEA/EQAR c.t.** have been described for Montana (Pfister and others 1977), Idaho (Steele and others 1981) and western Wyoming (Steele and others 1983). The **PICEA/EQAR c.t.** has also been described by Norton and others (1981). Our treatment of the type maintains the concept and extends the distribution into southeast Idaho.

Picea/Cornus stolonifera c.t.
(PICEA/COST)



DISTRIBUTION.—PICEA/COST is a major type within the lower portions of the Greys River drainage. It also occurs sporadically throughout the study area to the north and west. Stands are usually below 2 010 m (6,600 feet) in elevation, and are restricted to terraces immediately adjacent to streams. Slopes average about

5 percent. The **PICEA/COST c.t.** may be seasonally affected by high runoff. Boundaries with adjacent types are usually abrupt. Upland vegetation is often dominated by *Pinus contorta, Pseudotsuga menziesii*, or *Abies lasiocarpa;* these sites may belong to a variety of habitat types. Adjacent riparian types include those dominated by *Salix exigua* or *Cornus stolonifera*.

VEGETATION.—The overstory is dominated by *Picea engelmannii* or *Picea pungens*, although *Abies lasiocarpa* may also codominate. A dense shrub stratum characterizes the undergrowth, and includes *Cornus stolonifera, Alnus incana* or *Alnus sinuata, Rosa woodsii*, and sometimes *Ribes lacustre, Salix boothii*, and *Salix drummondiana* (fig. 3). Graminoids are usually negligible, but may vary with shrub density. A diverse assemblage of forbs includes *Actaea rubra, Aster foliaceus, Galium triflorum, Geranium richardsonii*, and *Equisetum arvense*.

SOILS.—Soils are derived from a variety of parent materials, but are predominately from Cretaceous sandstone and siltstone. Although soils in our studies belong to several different orders and subgroups (appendix D), all have similar family characteristics. Family particle-size classes are generally coarse and may contain at least 35 percent rock fragments at lower depths, resulting in a moderate available water capacity. Water tables range from 50 to 96 cm (20 to 38 inches).

SUCCESSION/MANAGEMENT.—Dense shrub cover in the **PICEA/COST c.t.**, along with the high structural diversity resulting from tree overstory, provides valuable habitat for many small mammals and birds. Big game may find abundant browse. However, forage for livestock is negligible (appendix C). **PICEA/COST** appears to be intermediate in succession between the **Cornus stolonifera/Galium triflorum** and the **Picea/Galium triflorum c.t.'s**, although **PICEA/COST** may be very persistent. Presumably, *Cornus stolonifera* can maintain its dominance of the undergrowth under relatively dense shade, and may be responding more to changes in the water table and the available water capacity.

OTHER STUDIES.—No other studies have described this c.t.

Figure 3.—**Picea/Cornus stolonifera c.t.** along the Greys River near Squaw Creek. The gently sloping bench (1 768 m, 5,800 feet) supports a dense overstory of mature *Picea engelmannii*, and a dense shrub stratum of *Cornus stolonifera* and *Rosa* species.

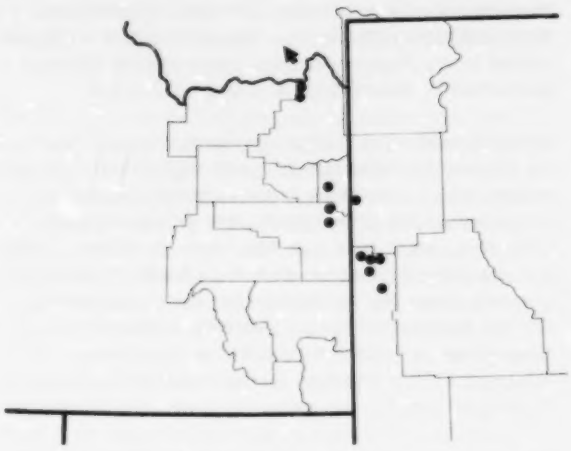
Picea/Calamagrostis canadensis c.t. (PICEA/CACA)

DISTRIBUTION.—PICEA/CACA is a minor c.t. that occurs sporadically throughout the middle and northern Rocky Mountains, but was noted only in the Greys River drainage within our study area. It typically occurs on moist toeslopes and pond margins.

VEGETATION.—*Both Picea engelmannii* and *Abies lasiocarpa* are present and create a relatively dense overstory. *Calamagrostis canadensis* is a conspicuous dominant in the undergrowth. A variety of shrubs, including *Lonicera involucrata, Ribes lacustre,* and *Salix* species, may be present on drier hummocks or raised microsites.

OTHER STUDIES.—PICEA/CACA c.t. is clearly a late seral stage within the **Abies lasiocarpa/Calamagrostis canadensis h.t.** described by Steele and others (1983), who also provided general management restrictions. This habitat type also has been described for Montana (Pfister and others 1977), central Idaho (Steele and others 1981), and northern Utah (Mauk and Henderson 1984).

Picea/Galium triflorum c.t. (PICEA/GATR)



DISTRIBUTION.—PICEA/GATR is a major c.t. of the study area, and is common throughout the lower Greys River drainage and the Big Hole Mountains. It also extends northward into Montana. It typically occurs on

Figure 4.—**Picea/Galium triflorum c.t.** on Trail Creek near the Wyoming-Idaho state line. The gently sloping bench (2 042 m, 6,700 feet) supports an overstory of *Picea engelmannii* and scattered *Abies lasiocarpa. Actaea rubra, Smilacina stellata,* and *Galium triflorum* are conspicuous forbs.

gently undulating or flat alluvial benches and terraces near streams and between 1 800 and 2 500 m (5,900 and 8,200 feet) in elevation. Adjacent upland plant communities may belong to a variety of habitat types supporting *Abies lasiocarpa*. Riparian c.t.'s nearby may include those dominated by *Salix wolfii*, *Alnus incana*, or *Cornus stolonifera*.

VEGETATION.—A relatively dense overstory contains mature *Picea engelmannii* or *Picea pungens*, *Abies lasiocarpa*, and occasionally seral *Pinus contorta*. Although a few shrubs such as *Ribes lacustre*, *Lonicera involucrata*, or *Symphoricarpos albus* may be found, the undergrowth is clearly dominated by forbs (fig. 4). A normally diverse mixture may include *Galium triflorum*, *Actaea rubra*, *Smilacina stellata*, *Geranium richardsonii*, and sometimes *Senecio triangularis* and *Thalictrum occidentale*. Frequently, additional forbs, such as *Fragaria virginiana* or *Aster foliaceus*, may be present with high coverages. We interpret these as indicating recent disturbances. Coverage of graminoids is normally negligible.

SOILS.—Soils are derived primarily from Cretaceous sediments. Family particle-size classes include coarse-loamy or strongly contrasting classes that contain at least 35 percent rock fragments at lower depths, with available water capacity low to moderate. Water tables averaged 76 cm (30 inches). Most soils belong to subgroups characterized by the presence of a mollic epipedon, or are the more developed and well-drained Cryofluvents encountered in our study area (appendix D).

SUCCESSION/MANAGEMENT.—Both vegetation and soil characteristics indicate relatively long-term stability. **PICEA/GATR** represents climax conditions within the **Picea engelmannii/Galium triflorum habitat type** described by Steele and others (1983). Management implications for timber are best discussed within the habitat type classification. Our data suggest relatively rapid development occurs on the more protected sites along drainages and seeps. On the more exposed benches and terraces and along streams with steeper gradients, intermediate stages represented by the **Cornus stolonifera/Galium triflorum** or **Picea/Cornus stolonifera c.t.** may develop. On extremely well-drained sites supporting the **Populus angustifolia/Cornus stolonifera** or **Populus angustifolia/ Poa pratensis c.t.**, the **PICEA/GATR c.t.** may still be a potential successional stage, but hypothetical conversion and development are beyond reliable prediction.

OTHER STUDIES.—Steele and others (1983) described similar vegetation within the habitat type classification for western Wyoming. Pfister and others (1977) discussed comparable conditions for south-central Montana. The **PICEA/GATR c.t.** was originally described by Norton and others (1980), and supplemented by Norton and others (1981). Our treatment refines the concept by excluding the seral stage that supports tall shrubs represented by the **Picea/Cornus stolonifera c.t.**

Populus angustifolia/ Cornus stolonifera c.t. (POAN/COST)

DISTRIBUTION.—This minor c.t. was found in the Big Hole Mountains and near Palisades Reservoir in eastern Idaho. Reconnaissance data indicate it is more common in northern Utah. Stands occur on alluvial benches or flats adjacent to streams at elevations below 1 980 m (6,500 feet).

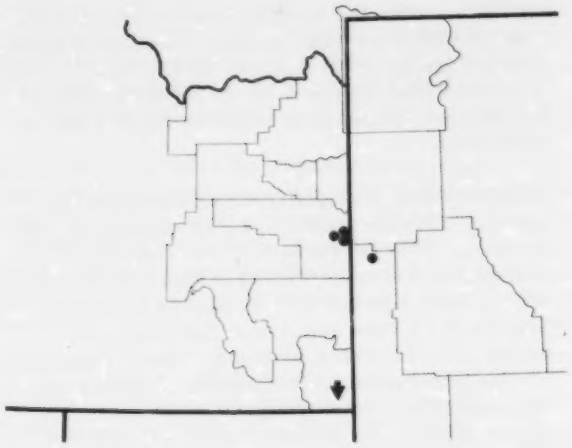
VEGETATION.—*Populus angustifolia* dominates the overstory, although occasional conifer saplings may be present as minor components of the understory. The undergrowth is characterized by *Cornus stolonifera* and other dense tall shrubs such as *Betula occidentalis*, *Salix bebbiana*, *Salix exigua*, and *Salix lutea*. Low shrubs include *Lonicera involucrata*, *Ribes hudsonianum*, and *Symphoricarpos albus*. Herbaceous species include *Poa pratensis* and minor amounts of *Elymus glaucus*, *Galium triflorum*, *Osmorhiza chilensis*, and *Smilacina stellata*.

SOILS.—Soils are highly permeable with sandy-skeletal or coarse-loamy over sandy-skeletal family particle-size classes. Water tables usually fluctuate enough for distinct mottles to form. Available water capacity appears to be low.

SUCCESSION/MANAGEMENT.—**POAN/COST** differs little from the **Picea/Cornus stolonifera** and **Cornus stolonifera/Galium triflorum c.t.'s**, with the exception of the *Populus angustifolia* overstory. This suggests a hypothetical succession of **Cornus stolonifera/Galium triflorum** to **POAN/COST** to eventually the **Picea/Galium triflorum c.t.** Management emphasis should be given to retention of the **POAN/COST c.t.** for its structural diversity and resulting wildlife habitat values.

OTHER STUDIES.—No other studies have described the **POAN/COST c.t.**

Populus angustifolia/Poa pratensis c.t. (POAN/POPR)



DISTRIBUTION.—POAN/POPR is a major c.t. of the lower Greys, Snake, and Gros Ventre Rivers in western Wyoming, and also occurs near the Palisades Reservoir and lower Snake River in eastern Idaho. Reconnaissance data indicate it is also common in northern Utah. Stands are usually found on broad alluvial terraces below 1 920 m (6,300 feet). Adjacent vegetation types are usually dominated by *Picea engelmannii*, *Populus tremuloides*, or *Salix exigua*.

VEGETATION.—*Populus angustifolia* dominates the overstory. *Picea engelmannii* or other conifers may be present as scattered saplings. They are clearly subordinate to *Populus angustifolia*, but indicate potential successional development. The undergrowth consists of a diverse mixture of graminoids and forbs, including *Poa pratensis, Elymus glaucus, Fragaria virginiana, Geranium viscosissimum*, and *Osmorhiza chilensis* (fig. 5). A sparse low shrub stratum occasionally over tops the herbaceous species, and includes *Lonicera involucrata, Rosa woodsii, Ribes lacustre*, and *Symphoricarpos albus*.

SOILS.—Limited data suggest the development of **POAN/POPR** is closely associated with coarse-textured soils having loamy-skeletal particle-size classes. Water tables are sometimes below 1 m (39 inches).

Figure 5.—**Populus angustifolia/Poa pratensis c.t.** on a broad alluvial terrace along the Snake River near Astoria Hot Springs in the Snake River Range (1 780 m, 5,840 feet). Scattered *Populus angustifolia* are the only trees on the site. The undergrowth consists of *Poa pratensis, Agropyron caninum*, and *Elymus glaucus*.

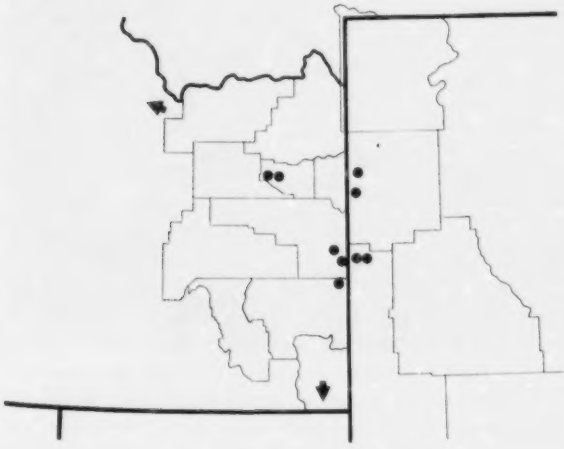
SUCCESSION/MANAGEMENT.—Because of its close proximity to streams and rivers, its open undergrowth, and broad, flat topography, recreational developments and transportation corridors are common uses of the **POAN/POPR c.t.**. Wildlife management options should normally emphasize requirements for cavity-dependent species and large accipiters. The presence of conifers will usually indicate the successional trend. However, *Populus angustifolia* is relatively persistent and conversion to another c.t. may be a very slow process. **POAN/POPR** represents one of the driest riparian situations; many non-riparian plant species are common. However, these sites do occasionally flood, resulting in seedbeds for *Populus* regeneration. Periodic disturbances, such as livestock browsings, also apparently result in suckering. Deep-seated *Populus* roots are able to utilize water that may be below the rooting depths of most obligate riparian species.

OTHER STUDIES.—Norton and others (1981) noted the presence of *Populus angustifolia* stands but did not describe the associated vegetation. No other studies have described the **POAN/POPR c.t.**

Mixed Shrub-Dominated Community Types

Nine shrub community types do not contain *Salix* species as dominant components. They range from the very moist *Alnus incana* and *Cornus stolonifera* communities to the relatively dry *Artemisia cana* communities. The types dominated by *Cornus stolonifera, Potentilla fruticosa*, and *Artemisia cana* are considered major riparian c.t.'s and can occur in large stands throughout much of the study area. Management opportunities and problems are strongly contrasting, and include livestock grazing in **Artemisia cana/Festuca idahoensis** and wildlife habitat conservation in **Cornus stolonifera/Heracleum lanatum**. Successional relationships are best discussed by c.t.

Alnus incana/Ribes hudsonianum c.t. (ALIN/RIHU)



DISTRIBUTION.—The **ALIN/RIHU c.t.** is found throughout much of the central portion of the study area. Similar conditions apparently exist westward in central Idaho and Oregon and may extend southward into northern Utah. **ALIN/RIHU** generally occurs below 2 040 m (6,700 feet) in elevation, and is usually found as narrow stringer communities adjacent to perennial streams. In especially narrow drainages, the vegetation may extend over the water, completely shading the stream. Adjacent upland communities are usually coniferous forests. In wider valley bottoms, *Salix exigua, Salix drummondiana,* and *Salix boothii* may dominate adjacent riparian c.t.'s.

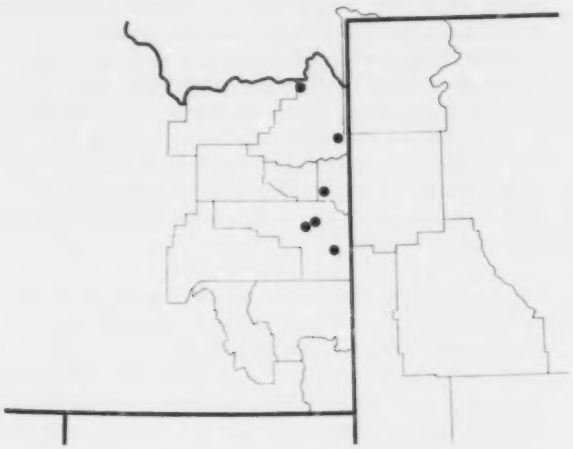
VEGETATION.—*Alnus incana, Alnus sinuata,* or *Cornus stolonifera* usually overtop a lower shrub stratum of *Ribes hudsonianum*. Associated herbaceous cover is highly variable and includes only minor amounts of *Heracleum lanatum, Smilacina stellata*, and *Actaea rubra*. *Alnus incana* may reach a height of 6 m (19.5 feet), with the lower shrub or herbaceous structure usually less than 1 m (39 inches) high.

SOILS.—Soils generally contain more than 35 percent rock fragments (appendix D). Typic or Cumulic Cryaquolls are most common. Water tables may fluctuate greatly, but are within 50 cm (20 inches) of the soil surface periodically, as indicated by shallow mottles. Available water capacity is variable.

SUCCESSION/MANAGEMENT.—These sites appear relatively stable. *Alnus, Cornus,* and *Ribes hudsonianum* can tolerate relatively severe flooding, and thus provide an excellent measure of streambank stability. Vertical structural diversity may provide habitat for many avian species. Browse is also available.

OTHER STUDIES.—Communities dominated by *Alnus* have been described by Tuhy and Jensen (1982) and Mutz and Queiroz (1983) for central Idaho, and Padgett (1981) for eastern Oregon. A broadly defined **Cornus stolonifera/Galium triflorum c.t.** which would include our **ALIN/RIHU** was described by Norton and others (1981).

Cornus stolonifera/Heracleum lanatum c.t. (COST/HELA)



DISTRIBUTION.—COST/HELA is a major c.t. within the eastern Idaho portion of the study area, but may also occur within the Greys River drainage at low elevations. Stands are found on flat alluvial benches in close proximity to high gradient streams and rivers. Elevations are generally below 2 010 m (6,600 feet). This c.t. often shares abrupt boundaries with adjacent upland vegetation types, that may support *Populus tremuloides, Abies lasiocarpa*, or *Pseudotsuga menziesii*.

VEGETATION.—The overstory is characterized by a dense and tall (2 to 4 m (6.5-13 feet)) shrub stratum dominated by *Cornus stolonifera* (fig. 6), occasionally overtopped by *Crataegus douglasii*. Other shrubs may include *Salix drummondiana* and *Rosa woodsii*. Although most stands contain numerous graminoid species, none attain dominance. The presence of *Heracleum lanatum* is diagnostic and distinguishes this c.t. from the closely related **Cornus stolonifera/Galium triflorum c.t.** Other common forbs include *Galium triflorum, Geum macrophyllum, Smilacina stellata*, and *Mertensia ciliata*.

SOILS.—Soils contain a thick mollic epipedon, indicating the relative stability of these sites. Most soils are either Cumulic or Typic Cyroborolls or Cryaquolls (appendix D). Although some soils may contain more than 35 percent rock fragments, the fine earth is usually

Figure 6.—**Cornus stolonifera/Heracleum lanatum c.t.** along the Little Greys River near Aspen Hollow. This narrow stringer community is dominated by *Cornus stolonifera*. The seed heads of *Heracleum lanatum* extend above the shrub canopy.

loamy. Water tables average 63 cm (25 inches) in depth, and available water capacity is moderate.

SUCCESSION/MANAGEMENT.—COST/HELA represents relatively stable vegetation, with very little potential for major change. Although conifers, especially *Picea*, can survive on sites supporting *Cornus stolonifera*, the invasion of *Picea* is probably a slow, gradual process. Dense shrubs and accumulations of organic matter on soil surfaces may prevent most seedling establishment. Occasional flooding with subsequent deposition of mineral soil may encourage conifer establishment. Therefore, the suggestion of a **COST/HELA** c.t. seral to the **Picea/Cornus stolonifera c.t.** is at best tentative. Soils data suggest significant differences between the **COST/HELA** and **Populus angustifolia/Cornus stolonifera c.t.'s.**

The dense shrub stratum of this c.t. generally prevents livestock grazing. Small mammals and avian species may seek shelter and food in this type while big game may find abundant browse. *Cornus stolonifera* is especially important for streambank stability and protection because of its thick root system. This is particularly important on the higher gradient stream channels where scouring by seasonal flooding is possible.

OTHER STUDIES.—No other studies have described the **COST/HELA c.t.**

Cornus stolonifera/Galium triflorum c.t. (COST/GATR)

DISTRIBUTION.—COST/GATR is a major c.t. throughout much of the study area and also extends into central Idaho. Reconnaissance data indicate it may also be common in northern Utah. It is found on narrow alluvial terraces and steep sideslopes adjacent to high gradient streams and rivers. Sample plots are all below 2 010 m (6,600 feet) in elevation. Adjacent vegetation types belong to a variety of habitat types, including those dominated by *Pseudotsuga menziesii, Picea engelmannii, Abies lasiocarpa*, and *Artemisia tridentata* ssp. *vaseyana*.

VEGETATION.—*Cornus stolonifera* dominates a dense tall shrub stratum, that may include *Crataegus douglasii, Salix boothii*, and sometimes *Salix lutea, Alnus*, and *Betula occidentalis*. Low shrubs include *Ribes lacustre* and *Rosa woodsii*. Diagnostic forbs are *Galium triflorum* and *Smilacina stellata*, usually present only in small amounts. Other common forbs include *Actaea rubra, Angelica arguta*, and *Equisetum arvense* with lesser amounts of *Heracleum lanatum*. *Elymus glaucus* and *Poa pratensis* are the most common graminoids, especially under slightly disturbed conditions. Occasionally, conifer saplings or mature individual trees may be found scattered throughout the drier portions of this c.t.

SOILS.—Soils are typically poorly developed and coarse textured, and belong primarily to the Aquic or Typic Cryofluvent subgroup (appendix D). Family particle-size classes are usually coarse-loamy, sandy, or contain more than 35 percent rock fragments, with low available water capacity. Profiles typically display strongly contrasting layers from repeated deposition of sand, loam, and fine gravel particles associated with periodic flooding from high stream runoff. Water tables vary from 50 to over 100 cm (20 to 39 inches) in depth, but proximity to perennial streams ensures a constant supply of water to the major shrubs.

SUCCESSION/MANAGEMENT.—While these communities are subject to recurring fluvial scouring and deposition, they are relatively stable because of the strong roots and vegetative reproduction of *Cornus stolonifera*. The presence of scattered conifers, especially *Picea* or *Abies lasiocarpa*, suggests possible conversion to the **Picea/Cornus stolonifera c.t.**, although this is likely a very slow process. Establishment of conifer seedlings is restricted by the thick organic accumulations on the soil surface and apparent intense competition for space within the rooting zone. Once established, however, conifers will modify the microsite, leading to the eventual reduction of *Cornus* and most other shrubs, typified by the **Picea/Galium triflorum c.t.**

Management should emphasize the importance of streambank stabilization. Although production of forbs and graminoids suitable for livestock may be moderate to high (appendix C), the dense shrub stratum will usually deter utilization. These communities may have higher value as wildlife habitat.

OTHER STUDIES.—A broadly-defined **COST/GATR c.t.** has been described for the Greys River drainage (Norton and others 1981). A similar broad **Alnus-Cornus c.t.** containing a variety of forbs and graminoids occurs along the Salmon and Middle Fork Salmon Rivers in central Idaho (Tuhy and Jensen 1982). Our treatment refines the concept of the **COST/GATR c.t.** for eastern Idaho and western Wyoming by recognizing this **COST/GATR**, the **Cornus stolonifera/Heracleum lanatum**, and the **Alnus incana/Ribes hudsonianum c.t.'s**, based on significant differences in vegetation and soils.

Rhamnus alnifolia c.t.
(RHAL)

DISTRIBUTION.—This minor c.t. is scattered throughout much of the study area, but is most common in the Caribou and Teton Ranges. It was noted, but not sampled, along the lower Greys and Little Greys River drainages. It typically occupies alluvial terraces and seeps below 2 070 m (6,800 feet) in elevation. Adjacent upland communities are often dominated by *Pseudotsuga menziesii, Abies lasiocarpa, Pinus contorta, Populus tremuloides,* or *Artemisia tridentata* ssp. *vaseyana.*

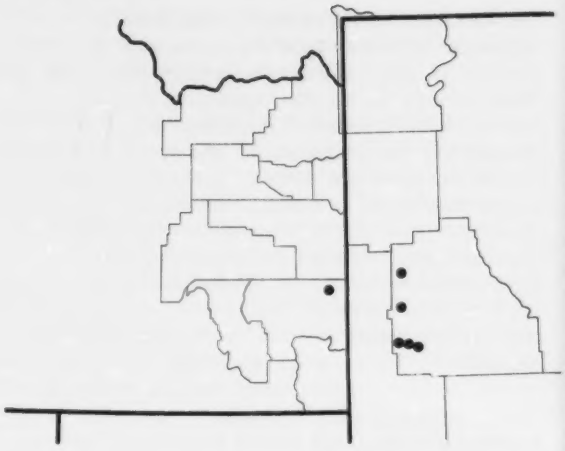
VEGETATION.— A dense, almost continuous layer of *Rhamnus alnifolia* shrubs about 1 m (39 inches) tall is characteristic.. Associated herbaceous species are quite variable, and include graminoids such as *Elymus glaucus* and *Calamagrostis canadensis,* and forbs such as *Galium triflorum, Heracleum lanatum,* and *Smilacina stellata. Rhamnus alnifolia* is a strongly rhizomatous, aggressive species that appears to form clones that may extend beyond the typical boundary of the riparian zone. It was noted as a dominant undergrowth even in non-riparian *Pinus contorta* stands.

SOILS.—Soils are often well-developed, with mollic epipedons and particle-size classes of fine-loamy or finer, although most contain more than 35 percent rock fragments. Water tables vary from 31 cm to over 1 m (12 to 39 inches) in depth with mottles or other signs of high water. Available water capacity is moderate.

SUCCESSION/MANAGEMENT.—The competitive nature of *Rhamnus alnifolia* makes it difficult for other shrub or tree species to become established. Where there is a mixture of species, we believe that *Rhamnus* has invaded these communities. The density of *Rhamnus* precludes grazing. Little browsing or other evidence of wildlife use was noted.

OTHER STUDIES.—No other studies have described this c.t.

Potentilla fruticosa/Deschampsia cespitosa c.t.
(POFR/DECE)



DISTRIBUTION.—POFR/DECE is found as a major c.t. in the eastern portion of the study area, and was also sampled in the Tincup Creek drainage of the Caribou Range. It typically occurs in broad, gently sloping alluvial bottoms between 1 980 and 2 530 m (6,500 and 8,300 feet) in elevation. Surface topography is usually smooth or sometimes convex. Adjacent communities on more moist sites may be dominated by *Salix wolfii* or *Salix boothii*, while drier sites usually support *Artemisia cana, Festuca idahoensis*, or our **Poa pratensis c.t.** Upland communities are often dominated by *Artemisia tridentata* ssp. *vaseyana.*

VEGETATION.—*Potentilla fruticosa* dominates a shrub layer that may also include *Artemisia cana* and *Salix wolfii*. This stratum is usually about 0.5 m (20 inches) tall. Other common riparian shrubs are noticeably absent. *Deschampsia cespitosa* is present as the diagnostic undergrowth species. Other herbaceous associates include *Carex microptera* and *Carex praegracilis. Poa pratensis, Fragaria virginiana, Helenium hoopesii,* and *Potentilla gracilis* are often present and may increase with surface disturbance (fig. 7).

SOILS.—Soils are derived from a variety of parent materials, but most contain weathered Cretaceous shale, sandstone, and siltstone. Sites have deep soils that belong to subgroups of Cryoborolls or Cryaquolls (appendix D), representing extensive development and incorporation of organic material. At the family level, loamy-skeletal or fine-loamy particle-size classes are represented, resulting in high available water capacity. Water tables are generally deep; free water is greater than 100 cm (39 inches) in a few profiles. However, all profiles examined contained mottles, indicating at least seasonal high water near the surface.

SUCCESSION/MANAGEMENT.—Limited observations indicate the **POFR/DECE c.t.** represents a gradual transition zone between poorly drained sites supporting

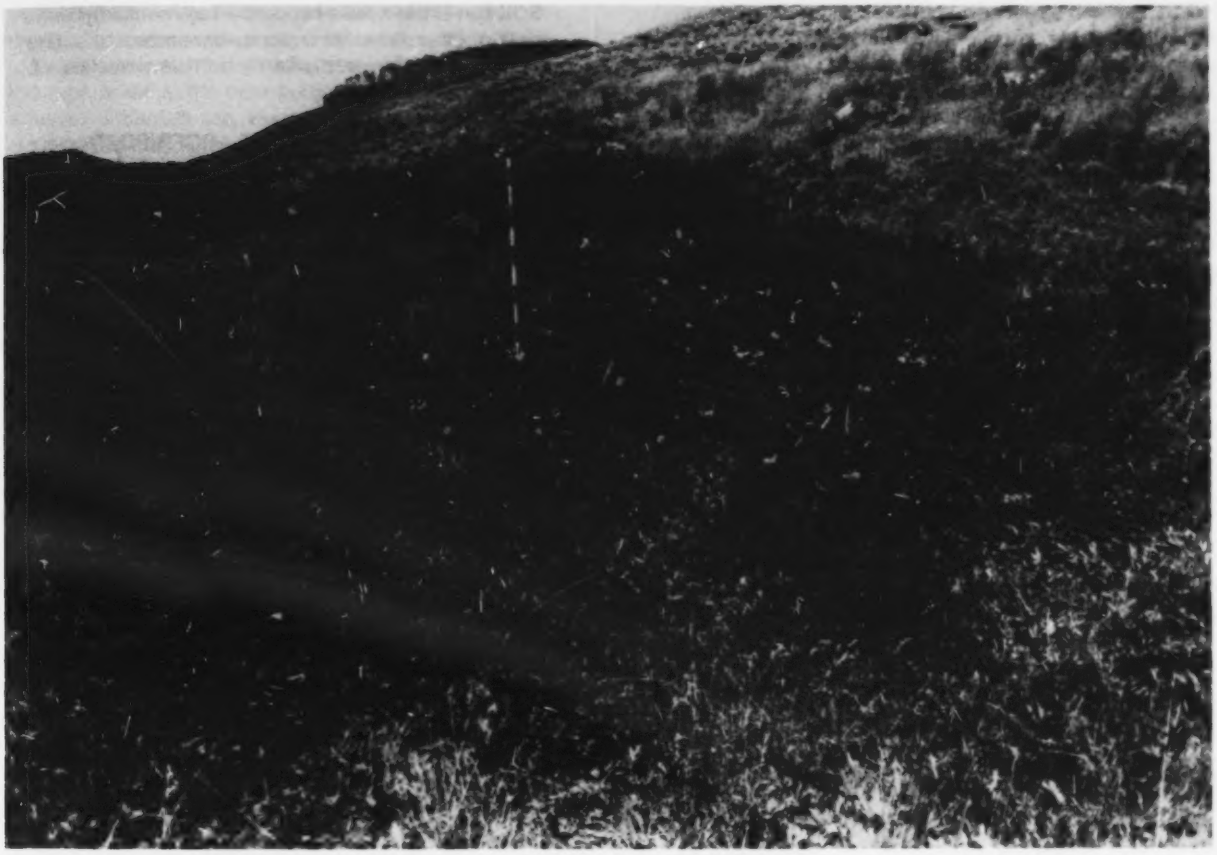


Figure 7.—**Potentilla fruticosa/Deschampsia cespitosa c.t.** on a flat near Tincup Creek in the Caribou Range (1 981 m, 6,500 feet). The site may have been part of an oxbow lake; it currently supports *Potentilla fruticosa, Deschampsia cespitosa,* and *Potentilla gracilis. Salix boothii* is visible in the background.

Salix wolfii and relatively dry sites supporting *Artemisia cana*. Thus, as ground water tables drop in broad meadows through stream cutting, the **POFR/DECE c.t.** may eventually be replaced by the **Artemisia cana/Festuca idahoensis c.t. Potentilla fruticosa/Festuca idahoensis** is apparently an intermediate stage. Understory production is moderate, with a major graminoid component (appendix C). All sampled sites displayed high vulnerability to grazing pressure. Attempts to manipulate *Potentilla fruticosa* density with fire or herbicides may be relatively ineffective. Where *Artemisia cana* is present, careful consideration should be given to its resprouting capabilities.

OTHER STUDIES.—A more broadly defined **POFR/DECE c.t.** has been described by Mutz and Graham (1982). Our treatment emphasizes the relatively undisturbed conditions within this **POFR/DECE**, and establishes the **Potentilla fruticosa/Poa pratensis c.t.** for disturbed sites.

Potentilla fruticosa/Festuca idahoensis c.t. (POFR/FEID)

DISTRIBUTION.—Within our study area, **POFR/FEID** is found sporadically throughout the east side of the Wyoming Range, and was also sampled in the Caribou Range. Similar plant communities have been noted north and east of our study area. Stands are found on broad, gently sloping and undulating alluvial benches between 1 920 and 2 500 m (6,300 and 8,200 feet) in elevation. A few communities extend into lower slope positions. **POFR/FEID** represents riparian communities that are relatively dry. Adjacent, more moist conditions support the **Potentilla fruticosa/Deschampsia cespitosa c.t.** or communities dominated by *Salix geyeriana* or *S. boothii*. Drier sites are usually best described as upland situations supporting *Artemisia tridentata* ssp. *vaseyana*, although **POFR/FEID** may occasionally grade into the **Artemisia cana/Festuca idahoensis c.t.** if slope gradients are very gentle.

VEGETATION.—Although both *Potentilla fruticosa* and *Artemisia cana* may codominate in a low shrub layer, the presence of *Potentilla* is considered diagnostic, indicating slightly more moist environments. *Festuca idahoensis* is conspicuous in the undergrowth. Common forbs include *Fragaria virginiana, Potentilla gracilis*, and *Helenium hoopesii*, that may represent previous disturbed conditions.

SOILS.—Soils of the **POFR/FEID c.t.** have developed in alluvium derived primarily from interbedded Cretaceous sandstone, siltstone, and shale. All of our sample profiles contained a mollic epipedon, and are classified to several Cryaquoll or Cryoboroll subgroups (appendix D). Family particle-size classes and water table differences are similar to the **Artemisia cana/Festuca idahoensis c.t.** Available water capacity ranges from moderate to high.

SUCCESSION/MANAGEMENT.—POFR/FEID communities represent broad ecotonal changes along a moisture gradient from true riparian to true upland conditions. *Potentilla fruticosa* is clearly restricted to subirrigated sites, but the diagnostic *Festuca idahoensis* is more commonly associated with drier sites supporting *Artemisia tridentata* ssp. *vaseyana*. The **POFR/FEID c.t.** appears relatively stable. However, under increased disturbance, especially from domestic livestock, *Festuca* may be replaced by *Poa pratensis* and additional forbs. This condition is best described by the **Potentilla fruticosa/Poa pratensis c.t.**

Undergrowth production is generally moderate (appendix C), with many desirable forage species for livestock. Management practices designed to control the density of shrubs are limited because of the shrub's ability to quickly resprout. Herbicide application must be carefully monitored to avoid open water.

OTHER STUDIES.—The **POFR/FEID c.t.** has been described as a habitat type in western Montana (Mueggler and Stewart 1980) where it occupies slightly more xeric sites. It also occurs east of the Continental Divide in Wyoming (Tweit and Houston 1980).

Potentilla fruticosa/Poa pratensis c.t. (POFR/POPR)

DISTRIBUTION.—This minor c.t. was sampled on the east slope of the Wyoming Range and in the Centennial Mountains. It occurs on sites similar to the closely related **Potentilla fruticosa/Festuca idahoensis** and **Potentilla fruticosa/Deschampsia cespitosa c.t.'s.**

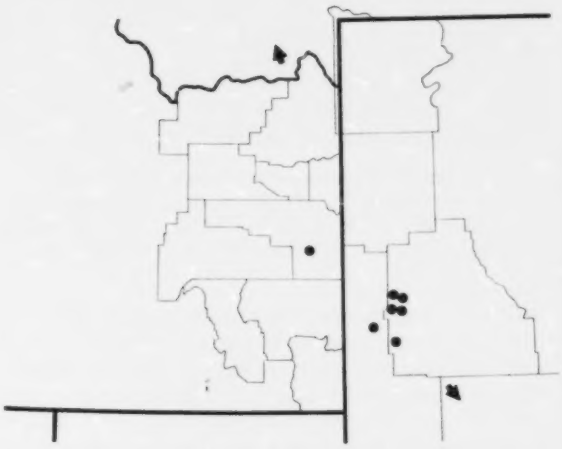
VEGETATION.—*Potentilla fruticosa* dominates a light shrub stratum that may include minor amounts of *Artemisia cana*. The undergrowth contains variable amounts of *Poa pratensis*, along with *Potentilla gracilis, Antennaria microphylla, Aster* spp., and *Fragaria virginiana*.

SOILS.—Limited data suggest a high similarity with soils of other *Potentilla fruticosa*-dominated c.t.'s. Sites belong to the fine-loamy family particle-size class of Calcic Cryoborolls.

SUCCESSION/MANAGEMENT.—POFR/POPR is apparently a disturbance-induced variant of either **Potentilla fruticosa/Deschampsia cespitosa** or **Potentilla fruticosa/Festuca idahoensis.** Continual grazing has eliminated the non-rhizomatous grasses, and encouraged the increase of forbs such as *Cirsium, Potentilla gracilis*, and *Fragaria*. Elimination of grazing will not necessarily result in a return to predisturbance conditions because the rhizomatous *Poa pratensis* may restrict the reestablishment of native *Deschampsia* or *Festuca* seedlings.

OTHER STUDIES.—This c.t. has been tentatively proposed by Mutz and Queiroz (1983). Somewhat similar communities apparently exist in central Idaho, and have been named based on the presence of *Danthonia intermedia* (Tuhy and Jensen 1982).

Artemisia cana/Festuca idahoensis c.t. (ARCA/FEID)



DISTRIBUTION.—ARCA/FEID is a major c.t. within the study area, and was sampled most frequently east of the Wyoming Range. It also occurs within the Gros Ventre drainage and extends outside our study area into Colorado, Idaho, and Montana. Communities are found on gently sloping alluvial benches, toeslopes, and seeps between 1 980 and 2 560 m (6,500 and 8,400 feet) in elevation. Most sites have eastern aspects and undulating surfaces. Adjacent upland communities are commonly dominated by *Artemisia tridentata* ssp. *vaseyana* and *Artemisia tridentata* ssp. *tridentata*. More moist riparian communities are often dominated by *Potentilla fruticosa, Salix boothii*, or *S. wolfii* with various grass undergrowths. Throughout its distribution, **ARCA/FEID** represents the driest extreme of the riparian zone. Boundaries with adjacent communities may be abrupt or gradual.

VEGETATION.—*Artemisia cana* is usually the only species in a conspicuous low shrub stratum (fig. 8). On the moist extreme, *Potentilla fruticosa* may grade into this type, while at the drier portions of the distribution, *Artemisia tridentata* ssp. *vaseyana* may occasionally occur. *Festuca idahoensis* is common in the undergrowth, which also may include *Carex microptera, Fragaria virginiana, Helenium hoopesii*, and *Potentilla gracilis.*

SOILS.—Soils have developed in alluvium derived from Cretaceous sediments, and have thick dark mollic epipedons (appendix D). Samples are classified predominately to loamy-skeletal or fine-loamy family particle-size classes. Although water tables generally are below the depth of the soil pit, mottling indicates at least an occasional upward fluctuation. Available water capacity is moderate.

SUCCESSION/MANAGEMENT.—The **ARCA/FEID c.t.** represents stable conditions. Although continual downcutting of streams may result in a lowering of water tables, many stands occur on sites with subirrigation from upland sites and are, therefore, not affected by adjacent streams. Under extended grazing pressure, *Festuca idahoensis* may be replaced by *Poa pratensis* and cover of forbs may increase. These communities would then belong to the **Artemisia cana/Poa pratensis c.t.** Although undergrowth production normally is low to moderate (appendix C), it may be greatly increased by controlling shrub densities. Herbicides have been effective in killing *Artemisia cana* and releasing *Festuca idahoensis* and other graminoids if applied when *Artemisia cana* is phenologically active. If grazing has eliminated the more desirable graminoids, broadleaf forbs such as *Geranium viscosissimum, Potentilla gracilis*, and *Fragaria virginiana* may dominate. Fire will usually result in rapid reestablishment of *Artemisia cana* through root sucker stimulation.

OTHER STUDIES.—More generalized descriptions of the **ARCA/FEID c.t.** have been developed by Mutz and Graham (1982), and Mutz and Queiroz (1983). A broadly defined **ARCA/FEID h.t.** has also been described for the Gros Ventre and Buffalo River drainages (Bramble-Brodahl 1978) and for southern Idaho (Hironaka and others 1983). Although not sampled, Mueggler and Stewart (1980) suggested that similar communities in western Montana in and near Yellowstone National Park are stable and belong to an **ARCA/FEID h.t.** Schlatterer (1972) described an **ARCA/FEID** community on deposi-

Figure 8.—**Artemisia cana/Festuca idahoensis c.t.** near Clear Creek in the Caribou Range, north of Grays Lake (1 981 m, 6,500 feet). The convex and gently sloping low ridges support a broken stand of *Artemisia cana* and *Festuca idahoensis. Potentilla gracilis* and *Wyethia amplexicaulis* are conspicuous forbs.

tional soils in the Sawtooth Mountains of central Idaho, and similar communities occur in Colorado (Smith 1966; Terwilliger and others 1979).

Artemisia cana/Poa pratensis c.t. (ARCA/POPR)

DISTRIBUTION.—This minor c.t. is found sporadically throughout the study area on sites similar to the **Artemisia cana/Festuca idahoensis c.t.**

VEGETATION.—ARCA/POPR represents a disturbance-induced variant of the more commonly occurring **Artemisia cana/Festuca idahoensis c.t.** Vegetation composition is similar except for the reduction of *Festuca idahoensis* and the increased cover of forbs such as *Helenium hoopesii, Fragaria virginiana, Potentilla gracilis, Valeriana occidentalis*, and *Aster* species. Although *Poa pratensis* is used to name the type, it is not always abundant. Other grasses include *Phleum pratense* and *Hordeum brachyantherum.*

SOILS.—Limited soils data suggest a high similarity with the **Artemisia cana/Festuca idahoensis c.t.**

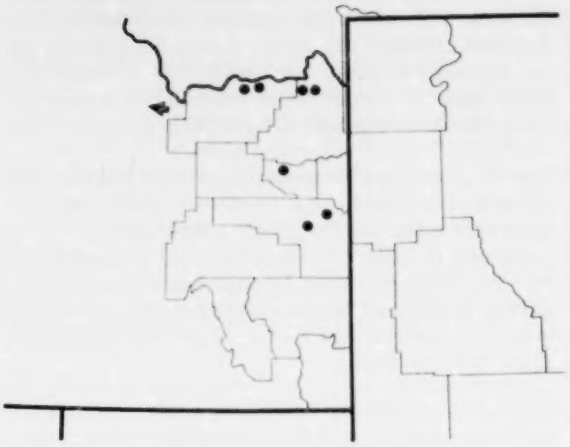
SUCCESSION/MANAGEMENT.—Under reduced grazing pressure, this c.t. may eventually regain a more natural species composition through the increase in *Festuca idahoensis*, although this process may be slow. Management objectives are similar to the **Artemisia cana/Festuca idahoensis c.t.**

OTHER STUDIES.—No other studies have described this c.t.

Salix geyeriana-Dominated Community Types

This relatively small group of c.t.'s is clearly dominated by *Salix geyeriana*, which is usually over 2 m (6.5 feet) tall in mature stands. The shrub canopy is characteristically open and clumpy, with large patches of *S. geyeriana* interspersed with a mixture of other *Salix* species. Rarely do other *Salix* species, such as *S. boothii, S. exigua*, or *S. drummondiana*, achieve this form and pattern. Like the *Salix boothii* group, *S. geyeriana* c.t.'s include very wet communities characterized by *Carex rostrata* and *Poa palustris* and relatively dry communities characterized by mesic forbs and *Poa pratensis*. Types are most commonly found at low elevations and in broad meadows. Soil characteristics are also relatively uniform; most c.t.'s within this group are found on fine textured soils with mottling near the surface and high available water capacity. In contrast, only the **Salix geyeriana/Mesic Forb c.t.** was found on sites with abundant coarse fragments. Streambank stability may be similar to the related types within the *S. boothii* group.

Salix geyeriana/Carex rostrata c.t. (SAGE/CARO)



DISTRIBUTION.—The **SAGE/CARO c.t.** is a major type that was sampled throughout the Centennial and Big Hole Mountains and the northern end of the Caribou Range. It also extends into central Idaho. Stands were usually found on broad benches or alluvial terraces below 2 130 m (7,000 feet) in elevation. Many appear to have developed in abandoned and sediment-filled beaver ponds. Adjacent riparian communities are usually dominated by Carices. Adjacent and drier sites often support non-riparian communities dominated by *Artemisia tridentata* ssp. *vaseyana* or conifers.

VEGETATION.—*Salix geyeriana* dominates the open overstory and characteristically appears in large, often widely-spaced clumps (fig. 9). Other shrubs that may be present include *Salix drummondiana*, and *Lonicera involucrata* or *Ribes inerme*, usually at the base of *S. geyeriana*. Although *Carex rostrata* has the highest constancy and was usually found with high cover, a few sample stands contained undergrowth dominated by *Carex aquatilis*; this may suggest designation of a new c.t. if additional stands are encountered. These wet sites may also support *Glyceria* species, *Equisetum arvense*, and small amounts of *Geum macrophyllum.*

SOILS.—This c.t. is usually supported by very poorly-drained Histosols and Cryaquolls (appendix D). Mineral horizons are all fine textured. Depth to water table averages 45 cm (18 inches) and ranges from the surface to 95 cm (37 inches). Available water capacity is high.

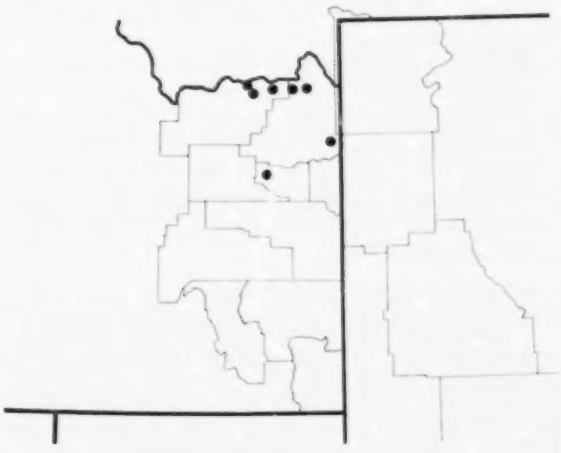
SUCCESSION/MANAGEMENT.—Characteristics of the undergrowth and soils suggest the **SAGE/CARO c.t.** is stable, with most communities occurring in place for considerable periods of time. Light surface disturbances may result in short-term changes in species composition, with a possible increase in coverage of *Poa* species and forbs. *Carex rostrata* or *Carex aquatilis* should usually regain complete dominance whenever

Figure 9.—**Salix geyeriana/Carex rostrata c.t.** on Rainey Creek in the Snake River Range near Sawn valley (1 719 m, 5,640 feet). Large clumps of *Salix geyeriana* and scattered *Salix bebbiana* dominate the overstory. The undergrowth is composed of various graminoids, including *Carex rostrata* and *Carex interior.*

disturbance factors are eliminated. Our observations suggest this c.t. may closely resemble the **Carex rostrata c.t.** in total undergrowth production. Production may be higher than the closely related **Salix boothii/Carex rostrata c.t.** because of the open shrub canopy. In general, management will be strongly influenced by the characteristics of the supporting soils. This c.t. provides habitat for birds such as the common yellowthroat or the song sparrow (Douglas and Ratti 1984).

OTHER STUDIES.—Mutz and Queiroz (1983) first described similar communities in the Centennial Mountains, and noted their presence along the South Fork of the Salmon River.

Salix geyeriana/Poa palustris c.t. (SAGE/POPA)



DISTRIBUTION.—The **SAGE/POPA c.t.** is found primarily in the Centennial Mountains of northeastern Idaho. It occurs as a major riparian type below about 2 040 m (6,700 feet) in elevation, on broad and flat valley bottoms or benches. Surface topography is usually smooth or gently undulating. Adjacent riparian communities may also contain *Salix geyeriana* with various undergrowths, or may be drier graminoid-dominated meadows described by our **Carex microptera**, **Poa palustris**, or **Mesic Forb Meadow c.t.'s.** Upland communities are usually composed of conifers.

VEGETATION.—A dense shrub canopy is dominated by *Salix geyeriana*, but may also contain significant amounts of *Salix boothii*. Other shrubs may include *Salix drummondiana* and *Salix bebbiana*. Graminoids clearly dominate the undergrowth, with *Poa palustris* the most abundant. Although *Carex aquatilis, Carex rostrata, Carex microptera*, and *Poa pratensis* all have high constancy, they usually contribute little to the total undergrowth cover. Other species that may be found include *Deschampsia cespitosa, Elymus glaucus, Glyceria* species, *Solidago canadensis, Potentilla gracilis*, and *Geum macrophyllum*.

SOILS.—Soils are usually Cumulic Cryaquolls (appendix D). Family particle-size classes are variable, but are usually fine-loamy or finer. Water tables range from 27 cm to deeper than 1 m (11 to 39 inches), but average 37 cm (15 inches). Those soils with a deep water table contain mottling near the surface, indicating moisture near the surface at least seasonally. Available water capacity is high.

SUCCESSION/MANAGEMENT.—Successional trends involving *Poa palustris* are unclear (see discussion of **POPA c.t.**, page 54). Although a few sample stands contain apparently young and dense *Salix geyeriana*, undergrowth is similar to stands where *Salix geyeriana* has developed into large clumps. We observed little indication of any major successional trend, and consider this type to be stable. However, because this c.t. contains species commonly utilized by livestock, and surface soil horizons are fine textured, there is a potential for soil loss if vegetative cover is removed. This may be especially important for stands in which *Salix geyeriana* has developed into clumps, leaving wide corridors easily accessible to livestock. Limited sampling suggests total undergrowth production is high to very high (appendix C).

OTHER STUDIES.—Mutz and Queiroz (1983) described a **SAGE/POPA c.t.** from the Centennial Mountains. Our treatment maintains their concept, and enlarges the distribution of this type.

Salix geyeriana/Calamagrostis canadensis c.t. (SAGE/CACA)

DISTRIBUTION.—The **SAGE/CACA c.t.** is apparently incidental to our study area, and occurs only in the Centennial Mountains. This type has been noted in central Idaho and also north central Colorado. Sample stands are found in broad valley bottoms at elevations below 2 130 m (7,000 feet). They are usually bordered by our **Salix boothii/Poa pratensis c.t.** or drier communities that contain a broad mixture of rangeland vegetation characterized by *Artemisia tridentata* ssp. *vaseyana* or *Wyethia amplexicaulis*. One stand is adjacent to a *Pinus contorta* stand. More moist sites usually support the **Salix geyeriana/Carex rostrata c.t.**

VEGETATION.—A relatively dense shrub canopy is dominated by *Salix geyeriana*. *Salix boothii* or *Salix drummondiana* have limited coverage throughout the community. The undergrowth is clearly dominated by *Calamagrostis canadensis*. Other species commonly encountered include *Carex rostrata, Poa palustris, Aster foliaceus, Galium boreale*, and *Potentilla gracilis*.

SOILS.—Soils usually contain a thickened mollic epipedon with fine textures. One site has a thin organic surface horizon. Water tables are variable.

SUCCESSION/MANAGEMENT.—Our concept of the **SAGE/CACA c.t.** follows that described for central Idaho (Tuhy and Jensen 1982). These authors pointed out the potential succession toward drier riparian types. However, we see little potential for these sites to support *Abies lasiocarpa* with a closed canopy, and thus it seems inappropriate to consider this c.t. an early successional stage within the **Abies lasiocarpa/ Calamagrostis canadensis habitat type**, as indicated by these authors. Also, our stands have developed on soils that do not show the lithologic discontinuities common to the sites in central Idaho. Limited data suggest more in-situ development and stability.

OTHER STUDIES.—The **SAGE/CACA c.t.** has been described for low and mid-elevations throughout central Idaho by Tuhy and Jensen (1982). Hess and Wasser (1982) found similar communities in north central Colorado.

Salix geyeriana/Mesic Forb c.t.
(SAGE/MF)

DISTRIBUTION.—This minor type is encountered sporadically throughout eastern Idaho, and within the Greys River drainage of Wyoming. Stands are all below 2 130 m (7,000 m) in elevation and occur on toeslopes, alluvial benches and broad valley bottoms.

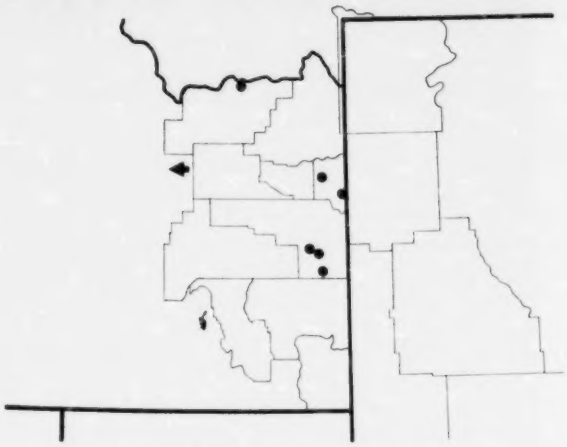
VEGETATION.—Floristically, this c.t. resembles the **Salix boothii/Smilacina stellata c.t.**, with *Salix geyeriana* rather than *Salix boothii* or *Salix drummondiana* contributing most to the overstory canopy cover. *Ribes lacustre* may also occur with significant coverage. The undergrowth is dominated by a variety of moist-site forbs, including *Thalictrum occidentale, Potentilla gracilis, Heracleum lanatum, Valeriana occidentalis, Aconitum columbianum,* or *Angelica arguta*. The most common grasses are *Poa pratensis* and *Elymus glaucus.*

SOILS.—Limited data indicate soils are relatively dry for riparian communities. Several sites are classified as Cumulic Cryoborolls. Like other types within this group, particle-size classes for the fine earth are usually fine-loamy or clayey; however, about half the soils contain more than 35 percent rock fragments. Water tables may be deeper than our other c.t.'s with *Salix geyeriana*. At several sample stands, water table depths exceed 1 m (39 inches), but mottling was usually near the surface. Available water capacity is moderate.

SUCCESSION/MANAGEMENT.—Little is known about successional relationships for this c.t. A few stands show a close affinity with the **Salix geyeriana/Poa pratensis c.t.**, which may represent disturbed conditions. However, soil characteristics are usually different. Because *Salix geyeriana* may persist for a long period of time, this c.t. may be considered relatively stable. The undergrowth species, especially the typically lush forbs, could be easily eliminated by severe surface disturbances. This c.t. may be related to our **Mesic Forb Meadow c.t.** if moisture levels drop and *Salix geyeriana* is eliminated. Management emphasis should be similar to that for our **Salix boothii/Smilacina stellata c.t.**

OTHER STUDIES.—The **SAGE/MF c.t.** has not been previously described.

Salix geyeriana/Poa pratensis c.t.
(SAGE/POPR)



DISTRIBUTION.—Our **SAGE/POPR c.t.** is found throughout eastern Idaho, where it may occur as a major riparian type. It also extends westward into central Idaho. Sample stands are found on broad alluvial terraces and meadows below 2 010 m (6,600 feet) in elevation. Surface topography is usually smooth or sometimes undulating. Adjacent riparian c.t.'s are most frequently herbaceous meadows, and may be described by our **Deschampsia cespitosa**, **Poa palustris**, or **Poa pratensis c.t.**, or may contain *Artemisia cana*. Upland sites usually support *Artemisia tridentata* ssp. *vaseyana.*

VEGETATION.—A normally dense shrub canopy is composed primarily of *Salix geyeriana. Lonicera involucrata* and *Ribes lacustre* may sometimes occur, forming a lower shrub layer. This c.t. may represent the densest and most uniform shrub stratum within this group of types. Undergrowth species are more varied, and include *Fragaria virginiana, Smilacina stellata, Potentilla gracilis, Juncus balticus*, and *Poa pratensis.*

SOILS.—Soils are commonly derived from calcareous mudstone, and usually classify as Cumulic or Typic Cryaquolls. Particle-size classes are clayey or fine-loamy. Water tables range from 30 to 140 cm (12 and 55 inches) and average 75 cm (30 inches). Some of our sites contain gleyed horizons at subsurface depths. Almost all have abundant mottling near the surface. Available water capacity is usually high.

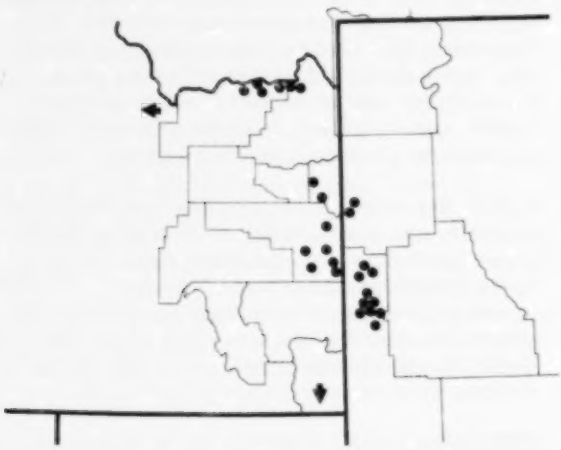
SUCCESSION/MANAGEMENT.—Stands appear relatively stable, with little indication of recent fluvial activity other than shallow, seasonal flooding. The relatively deep water tables and presence of non-riparian plant species, including many graminoids, suggests this c.t. may be somewhat similar to our **Salix geyeriana/Mesic Forb c.t.** This type may also share the potential for providing available forage for livestock if overstory densities are not excessive. However, the characteristically fine textured surface horizons are easily eroded if cover is removed or trampled.

OTHER STUDIES.—Although this c.t. has not previously been described, portions of it were included in the **Salix geyeriana-Salix myrtillifolia/Dry Corridor c.t.** of Mutz and Queiroz (1983).

Salix boothii-Dominated Community Types

Common throughout eastern Idaho and western Wyoming are riparian c.t.'s with tall shrubby canopies characterized by a mixture of *Salix boothii* and *Salix drummondiana* or dominance of either species. We have treated these two as ecological equivalents in recognition of their apparent compatibility. The eight c.t.'s within this group describe conditions ranging from very wet sites supporting *Carex rostrata* to relatively dry sites characterized by *Poa pratensis*. Included are undergrowths common to other *Salix*-dominated groups, such as *Salix geyeriana* or *Salix wolfii*. In addition to the overstory canopy, our types almost always include a second, lower shrub stratum featuring *Lonicera involucrata* and *Ribes* species. Overall height of *Salix* species may be reduced due to an apparent reaction to oxygen stress; our stands range in mean height from about 1.5 m (4.9 feet) in **Salix boothii/Carex rostrata** to greater than 5 m (16 feet) in **Salix boothii/Poa pratensis.** This feature may be especially important when resource managers consider manipulative efforts to increase browse for wild ungulates on winter range. Other notable features are presented by c.t.

Salix boothii/Carex rostata c.t. (SABO/CARO)



DISTRIBUTION.—The **SABO/CARO c.t.** is a major type that is found throughout eastern Idaho and western Wyoming. It also extends into northern Utah and central Idaho. Stands are found adjacent to small streams and on gently sloping seeps and toeslopes, between 1 800 and 2 380 m (5,900 and 7,800 feet) in elevation. Adjacent riparian communities may have a similar overstory with less hydric undergrowths. Other communities, with contrasting shrub compositions such as *Salix wolfii*, or no shrubs at all, usually have similar undergrowths dominated by either *Carex rostrata* or *Carex aquatilis*. Many **SABO/CARO** stands are found in relatively wide valley bottoms with small meandering streams. Other stands are clearly in depressions resulting from beaver activity.

VEGETATION.—Stands may be dense or open, and usually contain a mixture of *Salix boothii* and *Salix drummondiana*. *Lonicera involucrata, Ribes inerme*, or *Ribes lacustre* may often be present, but coverage is usually minor. The undergrowth is dominated by graminoids (fig. 10). Although *Carex rostrata* is present in all our sample stands, *Carex aquatilis* is sometimes more abundant. Unlike our **Salix wolfii/Carex rostrata** and **Salix wolfii/Carex aquatilis c.t.'s**, insufficient data exists to warrant separation of these situations into two types. The type is named after *Carex rostrata* because of its higher constancy and average cover. Other common undergrowth species that may be present in small amounts include *Equisetum arvense, Smilacina stellata*, and *Calamagrostis canadensis*. Limited data suggest *Salix drummondiana* and especially *Salix boothii* may be growing under more environmental stress within this c.t.; these species rarely exceeded 2 m (6.5 feet) in height.

SOILS.—Soils have apparently developed in alluvium from a variety of geologic materials. Most soils are classified as Typic or Cumulic Cryaquolls or Typic Cryaquents, and thus resemble those supporting our **Carex rostrata** and **Carex aquatilis c.t.'s.** In addition, a few soils are either Terric Histosols, Cryaquepts, or Cryofluents (appendix D). Dominant family particle-size classes are usually coarse-loamy, fine-loamy, or finer. Water table depths range from the surface to almost 1 m (39 inches), and average 32 cm (12 inches). Available water capacity is high.

SUCCESSION/MANAGEMENT.—Our **SABO/CARO c.t.** contains more successional variability than closely related types such as the **Salix wolfii/Carex rostrata** or **Salix wolfii/Carex aquatilis c.t.** Many stands appear to have developed in old beaver ponds or channels that have filled with sediments. These sites usually have soils that are poorly developed and may belong to the Entisols or Inceptisols. An apparent successional trend is from open water of the beaver pond to our **Carex rostrata** or **Carex aquatilis c.t.** to this **SABO/CARO c.t.** In contrast, other sample stands within this c.t. are found on narrow valley bottoms or seeps, and display characteristics of stability such as thick organic accumulations or soils classified as Cryaquolls.

Total undergrowth production is moderate to very high, depending on overstory density (appendix D). Many stands contain evidence of recent beaver and moose activity. Other features are somewhat similar to our **Salix geyeriana/Carex rostrata c.t.**

Figure 10.—**Salix boothii/Carex rostrata c.t.** on Packsaddle Creek in the Big Hole Mountains west of Driggs (1 993 m, 6,540 feet). *Salix boothii* is atypically tall in this community. The undergrowth is dominated by *Carex rostrata*. Forbs are noticeably sparce.

OTHER STUDIES.—Numerous workers have recognized the association of *Salix boothii* or *Saiix drummondiana* stands with *Carex rostrata*. Norton and others (1981) first named similar communities in the Greys River drainage. Mutz and Graham (1982) and Mutz and Queiroz (1983) extended the distribution along the Wyoming Range and the Centennial Mountains. Tuhy and Jensen (1982) included communities fitting this description in their **Salix/Carex rostrata c.t.** for central Idaho. Reconnaissance data indicate similar stands also exist throughout northern Utah. Our treatment maintains the conceptual basis of previous workers, and simplifies the name suggested by Mutz and Queiroz (1983).

Salix boothii/Carex nebrascensis c.t. (SABO/CANE)

DISTRIBUTION.—The **SABO/CANE c.t.** was sampled infrequently in the Centennial Mountains. The minor type is found at 2 100 m (6,900 feet) on a seep and a bench adjacent to a small stream in the Miners Creek drainage. Surface topography is hummocky.

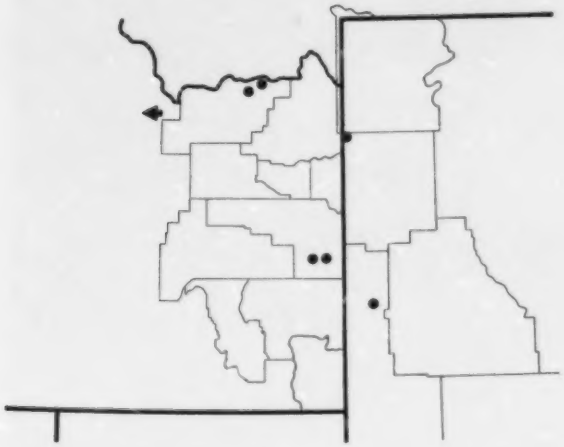
VEGETATION.—A broken canopy of *Salix boothii* dominates a dense layer of *Carex nebrascensis*. One sample stand contains other shrubs, including *Salix lutea* and *Salix bebbiana*. Other features of the undergrowth are similar to our **Salix wolfii/Carex nebrascensis c.t.**

SOILS.—Soils include a Histic Cryaquoll, fine-loamy, and Typic Cryaquoll, coarse-loamy. Water tables are near or at the soil surface.

SUCCESSION/MANAGEMENT.—Sample stands contain *Salix boothii* clumps that were heavily browsed. Also, the undergrowth has been grazed and trampled, presumably by livestock. Because *Carex nebrascensis* is usually more palatable than other associated graminoids, these sites may be sought by cattle. Fine textured soils may be quickly eroded if grazing and trampling result in baring the soil surface. These sites may need careful monitoring to assure maintenance of site characteristics.

OTHER STUDIES.—The **SABO/CANE c.t.** has not been previously described.

Salix boothii/Calamagrostis canadensis c.t. (SABO/CACA)



DISTRIBUTION.—This minor c.t. was sampled infrequently throughout eastern Idaho, and is also found along the Greys River in western Wyoming. It may be more extensive in central Idaho. Stands are found on gentle slopes or flat benches near streams. Elevations range from about 1 890 to 2 290 m (6,100 to 7,500 feet). Surfaces are usually undulating. Adjacent riparian c.t.'s are diverse, and include those containing *Salix boothii* and *Salix geyeriana* in the overstory. Also in close proximity may be those c.t.'s which contain *Carex rostrata* in the undergrowth.

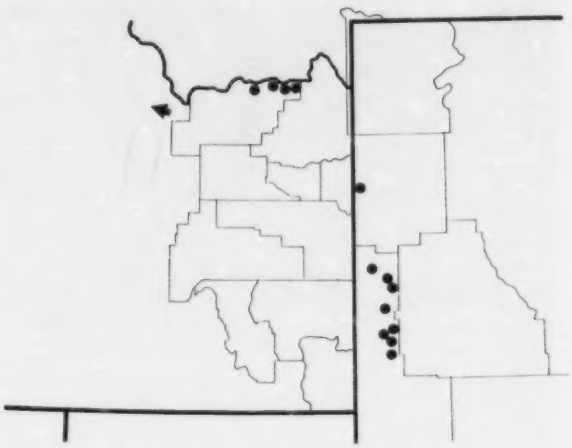
VEGETATION.—A dense shrub canopy, dominated by either *Salix boothii* or *Salix drummondiana*, may exceed 2 m (6.5 feet) in height. Both *Lonicera involucrata* and *Ribes lacustre* have high constancy and produce a conspicuous layer at a height of about 0.5 m (20 inches). The undergrowth is characterized by a dense sward of *Calamagrostis canadensis*. *Carex rostrata* may sometimes be present in lesser amounts.

SOILS.—Soils are classified predominately as Cumulic Cryaquolls, with fine-loamy or clayey family particle-size classes. Water tables range from 15 cm to over 1 m (6 to 39 inches) in depth, and average 59 cm (23 inches). Distinct mottling is present near the surface of most profiles. Available water capacity is high.

SUCCESSION/MANAGEMENT.—Little is known about successional trends. Our assumption, based upon soil characteristics, is that these stands have been in place for considerable time. In general, management of these communities may be similar to that of our **Salix geyeriana/Calamagrostis canadonsis c.t.**

OTHER STUDIES.—A much broader concept of this type has been discussed for central Idaho (Tuhy and Jensen 1982). Mutz and Queiroz (1983) reported similar communities in the Centennial Mountains. Our treatment refines the concept of these workers, resulting in less variability of vegetation and site parameters.

Salix boothii/Equisetum arvense c.t. (SABO/EQAR)



DISTRIBUTION.—The **SABO/EQAR c.t.** is found as a major type within the Greys River drainage and Centennial Mountains. It also occurs sporadically throughout other portions of our study area, and extends into central Idaho. Stands are found adjacent to small streams and often on steep toeslope seeps in narrow valley bottoms. Elevations are between about 1 920 and 2 710 m (6,300 and 8,900 feet) Surface topography is characteristically undulating. The **SABO/EQAR c.t.** is usually bordered by other communities containing *Carex rostrata*; these may also include *Salix boothii* or *Salix wolfii*. Conifer stands may border this type, especially on the toeslopes. These stands usually will belong to our **Picea/Equisetum arvense c.t.** Other neighboring communities may be described by the **Salix boothii/Smilacina stellata**, **Salix wolfii/Mesic Forb**, or **Mertensia ciliata c.t.**

VEGETATION.—Either *Salix boothii* or *Salix drummondiana* dominate a dense shrub canopy that averages 2 m (6.5 feet) in height. Like most other c.t.'s within this group, *Ribes inerme* or *Ribes lacustre*, and *Lonicera involucrata* may create a notable layer under the dominant *Salix* species. The undergrowth contains high coverage of *Equisetum arvense* or *Saxifraga odontoloma*. Other species with high constancy include *Geranium richardsonii* and *Geum macrophyllum*.

SOILS.—We found this c.t. represented on soils with family particle-size classes ranging from sandy-skeletal to clayey (appendix D), with no consistent pattern of corresponding depth to the water table or surface topography.

SUCCESSION/MANAGEMENT.—Because of the variability of site characteristics associated with this c.t., we find it difficult to suggest clear successional trends. Some sample stands are found on stable sites where organic accumulations exceeded 30 cm (12 inches). Other stands include small amounts of conifers, and thus suggest a potential relationship with our

Picea/Equisetum arvense c.t. A third possibility is expressed by stands found on recent alluvium over buried surface horizons. Floristically, these stands may be intergrades to our **Salix boothii/Smilacina stellata c.t.** *Equisetum arvense* appears to tolerate great seasonal fluctuations in the water table and physical stresses associated with scouring and deposition.

OTHER STUDIES.—A much broader situation that contains similar floristic features has previously been described by Mutz and Queiroz (1983) as the **Salix drummondiana-Salix rigida/Equisetum arvense c.t.** It occurs in the Centennial Mountains and portions of central Idaho. The **SABO/EQAR c.t.** as presented here has not previously been discussed.

Salix boothii/Poa palustris c.t. (SABO/POPA)

DISTRIBUTION.—This minor c.t. was sampled infrequently only in the Caribou Range of eastern Idaho. It is found on alluvial terraces adjacent to small streams below 1 890 m (6,200 feet).

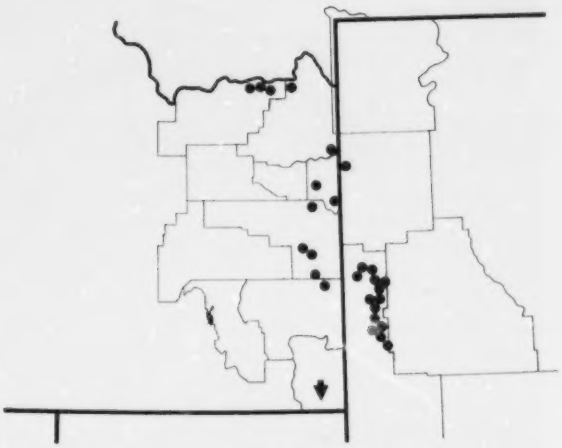
VEGETATION.—Although dominated by *Salix boothii*, *Salix geyeriana* is present in our sample stands. *Poa palustris* is conspicuous in the undergrowth. Thus, these stands may resemble those described by our **Salix geyeriana/Poa palustris c.t.**

SOILS.—Soils are similar to those of the **Salix geyeriana/Poa palustris c.t.** All are fine textured, and have water tables less than 55 cm (22 inches) in depth.

SUCCESSION/MANAGEMENT.—Limited data prevent clearly discernable successional relationships. We suggest management practices similar to those for **Salix geyeriana/Poa palustris** until further study proves otherwise.

OTHER STUDIES.—This c.t. has not been described in other studies.

Salix boothii/Smilacina stellata c.t. (SABO/SMST)



DISTRIBUTION.—The **SABO/SMST c.t.** is common throughout much of eastern Idaho and western Wyoming. It was sampled extensively within the Greys River drainage, but apparently does not occur eastward along the lower slopes of the Wyoming Range. Reconnaissance data indicate it may also be common in northern Utah. Stands range in elevation from about 1 830 to 2 260 m (6,000 to 7,400 feet), except within the Greys River drainage, where this type extends up to about 2 650 m (8,700 feet). Gently sloping benches adjacent to streams are the most common position, although several sample stands are found on steep (15-25 percent) toeslopes adjacent to or on top of seeps or slumps. A broad mixture of riparian c.t.'s may be adjacent to this **SABO/SMST** c.t., most of which will also be dominated by *Salix boothii*. Occasionally, more moist sites may support *Salix wolfii*. Many of our stands are adjacent to slopes supporting conifer stands of *Abies lasiocarpa* and *Pinus contorta*. Where the ecotone between this c.t. and forested communities is broader, a forb community containing *Geranium viscosissimum* or a sagebrush steppe with *Artemisia tridentata* ssp. *vaseyana* or *Artemisia cana* may develop.

VEGETATION.—The dense overstory (fig. 11) ranges from almost pure *Salix boothii* to pure *Salix drummondiana*. Mature stands that contain *Salix boothii* may reach 2.0 m (6.5 feet) in height. Occasionally, *Salix drummondiana* clumps may be as tall as 3 m (9.7 feet). *Ribes lacustre* or *Ribes inerme* is usually found at the base of the *Salix* clumps. *Lonicera involucrata* may also be common. The undergrowth is characteristically forby, and comprised of a mixture of species commonly found in non-riparian communities. We have selected *Smilacina stellata* to represent the undergrowth because of its high constancy. Other common associates include *Heracleum lanatum, Mertensia ciliata, Thalictrum occidentale, Thalictrum fendleri, Galium triflorum*, or *Angelica* species. Occasionally, apparently disturbed communities may contain *Solidago canadensis, Urtica dioica, Fragaria virginiana, Aster foliaceus*, or *Potentilla*

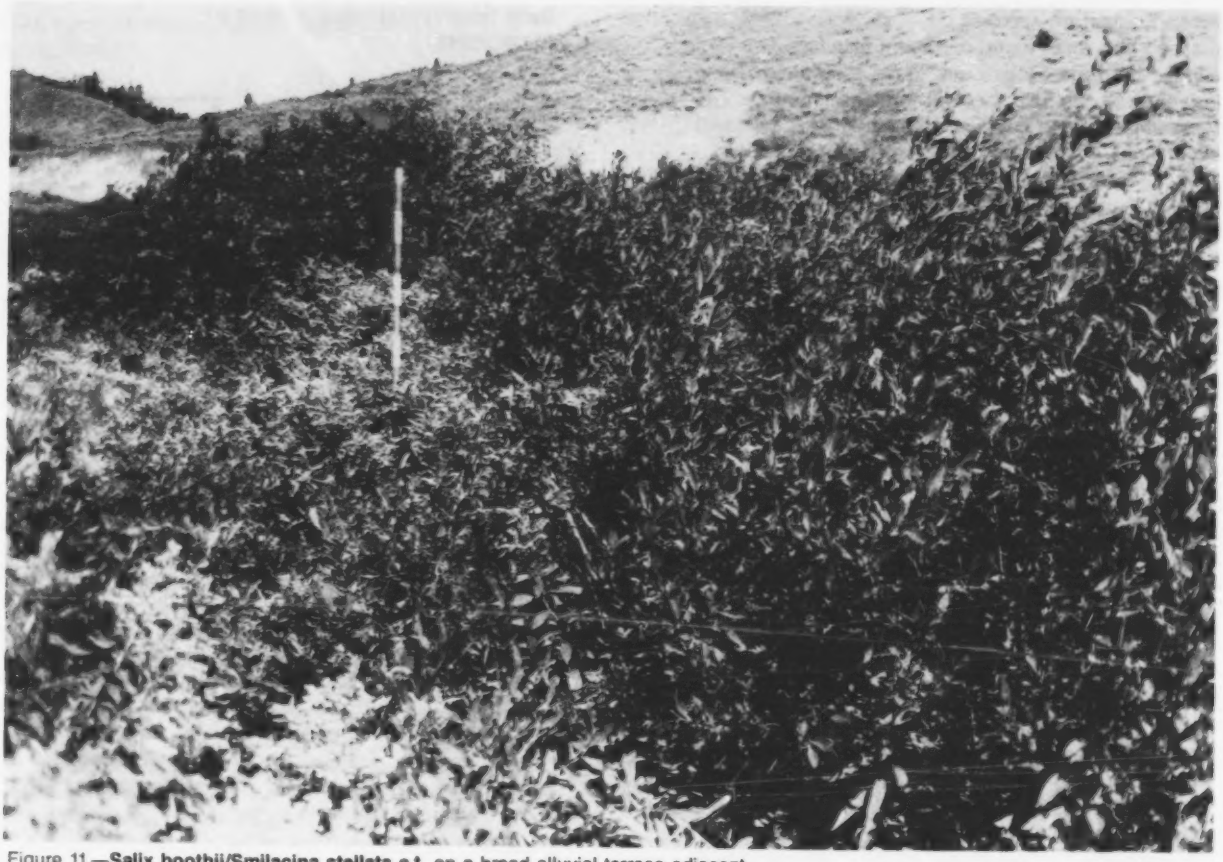


Figure 11.—**Salix boothii/Smilacina stellata c.t.** on a broad alluvial terrace adjacent to Tincup Creek in the Caribou Range (1 950 m, 6,400 feet). The dense shrub layer consists of *Salix boothii, Salix drummondiana,* and *Lonicera involucrata. Smilacina stellata* and *Thalictrum occidentale* are the most abundant forbs concealed by the overstory.

gracilis. Poa pratensis, if present, is usually only a minor component of the undergrowth. Other graminoids may include small amounts of *Deschampsia cespitosa, Carex rostrata, Poa palustris*, and *Bromus ciliatus.*

SOILS.—Soils are predominantly Cryofluvents or Cryaquents, indicating their relatively recent deposition and lack of development. Representative family textural-classes are coarse-loamy or fine-loamy. Surface horizons are commonly brown, brownish-gray or lighter in color. About one-third of our soils are classified as Cumulic Cryaquolls or Cryoborolls, and thus may represent an intergrade with our **Salix boothii/Poa pratensis c.t.** These soils often show indications of more long-term development and greater incorporation of organic matter. Available water capacity varies from low to high, and averages moderate. This wide range suggests a corresponding wide range in soil moisture available for plant uptake. However, water tables are usually between 60 and 100 cm (24 and 39 inches) in depth.

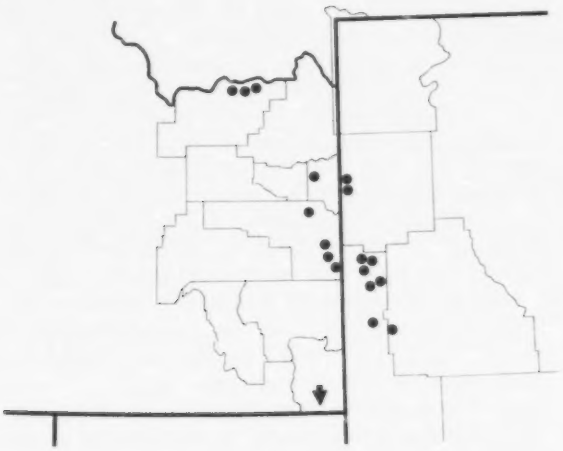
SUCCESSION/MANAGEMENT.—The **SABO/SMST c.t.** represents a confusing array of successional conditions. The majority of stands have developed on soils exhibiting properties of relatively recent deposition. Other stands, with no discernable differences in floristic composition, are found on soils that have apparently developed in place for a long period of time. These stands may be related to our **Salix geyeriana/Mesic Forb c.t.** and could undergo slow conversion from a dense shrub canopy of *Salix boothii* and *Salix drummondiana* to an open canopy of *Salix geyeriana*. However, as noted previously, *Salix geyeriana* rarely occurs above 6 130 m (7,000 feet) in elevation in our study area. Limited observations also suggest the possibility that some stands may be successional to forb-dominated communities commonly found on upland sites.

In general, stands that comprise this c.t. contain a dense shrub canopy that usually impedes livestock access to the stream course and the undergrowth. Total undergrowth production is high to very high (appendix C). Many avian species appear to utilize these stands. Douglas and Ratti (1984) found warbling vireos, black-headed grosbeaks, white-crowned sparrows, calliope hummingbirds, and Wilson's warblers common in these

dense stands when the undergrowth was relatively short and composed of *Thalictrum occidentale* and *Fragaria virginiana*. The moist extremes of this c.t., which may support taller forbs such as *Solidago canadensis, Cirsium,* and *Angelica arguta,* may provide habitat for flycatchers and MacGillivray warblers. Yellow-bellied sapsuckers are found in stands containing *Heracleum lanatum,* especially where upland stands of *Populus tremuloides* and conifers are nearby.

OTHER STUDIES.—Portions of our **SABO/SMST c.t.** have been referred to by a variety of names. Norton and others (1980) considered *Thalictrum fendleri* diagnostic in the undergrowth. Mutz and Queiroz (1983) used a binomial overstory name and a descriptive undergrowth epithet (**Salix drummondiana-Salix myrtillifolia/Cornus stolonifera-Dry corridor**). Our treatment of the **SABO/SMST c.t.** is original.

Salix boothii/Poa pratensis c.t. (SABO/POPR)



DISTRIBUTION.—Our **SABO/POPR c.t.** occurs as a major riparian type throughout the study area, and may be especially common on the Greys River drainage. Reconnaissance data indicate it may also be common in northern Utah. Sample stands range from about 1 770 to 2 530 m (5,800 to 8,300 feet) in elevation on flat streams. Adjacent riparian c.t.'s include our **Salix exigua/Poa pratensis** and **Salix boothii/Smilicina stellata** or **Salix boothii/Carex rostrata** on more moist sites. Drier conditions may support our **Mesic Forb Meadow c.t.**, or upland communities dominated by forbs and described by Gregory (1983) as the **Helenium hoopesii** or **Artemisia ludoviciana-Valeriana edulis c.t.**

VEGETATION.—Although the overstory is named after the presence of *Salix boothii*, many other shrubs may be present, often with high cover. Like other c.t.'s within this group, *Salix drummondiana* shares dominance with *Salix boothii*, and may be as tall as 5 m (16 feet). *Ribes lacustre* and *Lonicera involucrata* create a second conspicuous layer. Other shrubs, more characteristic of drier environments, are often present. These include *Rosa woodsii, Crataegus douglasii, Amelanchier alnifolia,* and *Symphoricarpos albus*. Also present may be clumps of *Cornus stolonifera* or *Salix exigua*. Underneath this shrub canopy, which is more open than our **Salix boothii/Smilacina stellata c.t.**, is a low, diverse undergrowth that often includes *Poa pratensis*. Other grasses that may be more conspicuous include *Agrostis stolonifera, Bromus ciliatus, Phleum pratense,* or *Bromus anomalus*. Forb cover is considerably less extensive than in our **Salix boothii/Smilacina stellata c.t.**, and usually consists of species such as *Aster foliaceus, Fragaria virginiana, Taraxacum officinale,* or *Rudbeckia occidentalis*.

SOILS.—Soils are classified predominately as Pachic or Aquic Cryoborolls, or Typic or Cumulic Cryaquolls (appendix D), indicating relatively thick accumulations of mineralized organic matter. Family particle-size classes are diverse and range from clayey and fine-loamy to sandy-skeletal. About one quarter of our soils are Typic Cryofluvents and thus represent an apparent intergrade with soils commonly supporting our **Salix boothii/Smilacina stellata c.t.** Generally, water tables exceed 1 m (39 inches) in depth. Available water capacity varies from very low to high.

SUCCESSION/MANAGEMENT.—Like **Salix boothii/Smilacina stellata**, successional relationships are unclear. Many stands show characteristics of extended soil development, but with floristic compositions common of disturbed areas. Many stands are on sites that are readily accessible to livestock and may have been more heavily utilized in the recent past. With severe physical disturbance, these stands may become further degraded. Soil characteristics suggest these sites may be easily eroded if ground cover is lost, and slope stability along the streambanks may be a management concern.

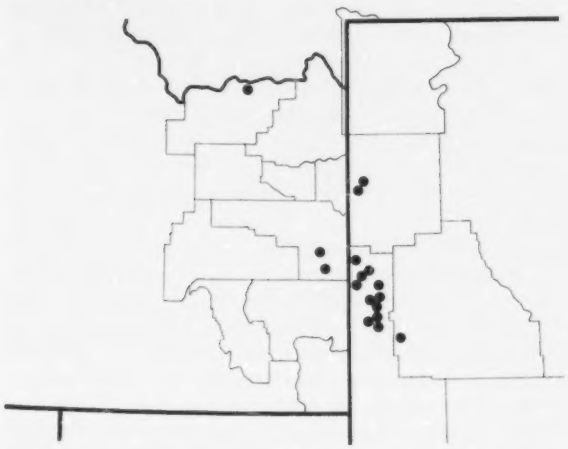
OTHER STUDIES.—Our **SABO/POPR c.t.** is more restrictive than the previously described **Salix boothii/Poa pratensis** for the Greys River (Norton and others 1981), and followed by Mutz and Queiroz (1983).

Salix wolfii-Dominated Community Types

Salix wolfii often occurs as a relatively minor associate on sites supporting *Potentilla fruticosa* or *Artemisia cana*, and in most *Salix boothii*-dominated c.t.'s. Where most other riparian shrubs are absent at upper elevations, *Salix wolfii* may occur in large homogeneous stands. The low stature of stands belonging to these c.t.'s is immediately conspicuous. *Salix wolfii* ranges from about 50 cm (20 inches) tall in our **Salix wolfii/Carex rostrata** and **Salix wolfii/Carex aquatilis c.t.'s** to about 1.2 m (47 inches) in our **Salix wolfii/Mesic Forb c.t.** Shrub strata are usually pure *S. wolfii*; only the **Salix wolfii/Mesic Forb c.t.** has a relatively diverse mixture of associates. Undergrowths are similar to the *Salix boothii*-dominated c.t.'s, and include wet graminoid types

characterized by *Carex rostrata, Carex aquatilis*, or *Calamagrostis canadensis*; mesic graminoid types dominated by *Carex nebrascensis* or *Deschampsia cespitosa*; and relatively xeric types that contain a mixture of mesic forbs. In general, these *Salix wolfii* types occur at mid- to upper elevations in broad meadows, alluvial terraces, and seeps. Slopes may often be in excess of 20 percent, but streambank stability is rarely a problem because most channels are small and meander and soils contain a high amount of live roots. During periods of high runoff associated with snowmelt, overland flow is common. Wildlife values are not well documented, but these types may provide habitat similar to our **Salix planifolia c.t.**

Salix wolfii/Carex aquatilis c.t. (SAWO/CAAQ)



DISTRIBUTION.—The **SAWO/CAAQ** is a major c.t. that occurs throughout our study area. It is found most frequently in the Greys River drainage. Typical sites are alluvial terraces, broad wet meadows, and seeps along toeslopes. Elevations range from 1 950 to 2 530 m (6,400 to 8,300 feet). This c.t. may be adjacent to graminoid-dominated riparian types such as our **Carex rostrata** or **Carex aquatilis** or may border drier types such as the **Salix wolfii/Mesic Forb c.t.** The **SAWO/CAAQ c.t.** is also found below communities dominated by *Potentilla fruticosa* or *Artemisia cana*; these ecotones usually correspond to sharp breaks in surface topography.

VEGETATION.—The overstory is a low shrub layer dominated by *Salix wolfii*. A few stands also contained small amounts of *Betula glandulosa* and *Potentilla fruticosa*. A dense sward of *Carex aquatilis* characterizes the undergrowth (fig. 12). Although *Carex rostrata* may also be abundant, it is clearly subordinate to *Carex aquatilis*. One sample stand contained a relatively depauperate undergrowth, with *Pedicularis groenlandica* more abundant than *C. aquatilis*. It was placed within this c.t. because other attributes are similar. In addition to *Pedicularis groenlandica*, other common forbs within this type include *Polemonium occidentale*, with *Aster foliaceus* and *Fragaria virginiana* on drier microsites. Most stands also have at least 50 percent canopy cover of moss.

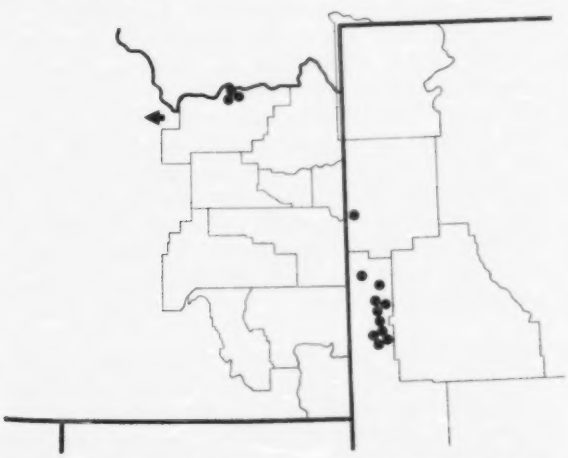
SOILS.—Soils apparently are derived from mostly sedimentary geologic materials. Soil taxa are diverse and include Cryaquents, Cryaquolls, and Histosols (appendix D). However, a common feature is the presence of a relatively thick organic surface horizon. Depth to water table averages 28 cm (11 inches). Occasional sites that lack organic accumulation have mineral horizons that are fine textured, thus available water capacity is high. Water moves laterally through the profile and appears to be relatively constant throughout the growing season.

SUCCESSION/MANAGEMENT.—Analysis of species composition data and general observations suggest a gradual conversion from the **Salix wolfii/Carex rostrata c.t.** to this **SAWO/CAAQ c.t.** Apparently, *Salix wolfii* and the different *Carex* species gradually contribute organic matter that fails to decompose and mineralize because of a constant high water table. As organic layers build and free oxygen becomes available through lateral movement of water, *Carex aquatilis* may gradually replace *Carex rostrata*. We have no evidence to suggest any successional connection between this c.t. and the **Salix wolfii/Mesic Forb c.t.**; soil attributes are quite dissimilar. Limited data indicate annual production of graminoids and forbs is high, and is similar to the **Salix wolfii/Carex rostrata c.t.**

OTHER STUDIES.—The **SAWO/CAAQ c.t.** was previously undescribed. Portions of this type have been included in the **Salix wolfii/Swertia perennis c.t.** described by Norton and others (1981). Our data indicate *Swertia perennis* has very low constancy. Mutz and Queiroz (1983) described a **Salix wolfii-Betula glandulosa/Carex rostrata-Carex aquatilis c.t.** from the South Fork Salmon River that, at least partially, resembles this **SAWO/CAAQ c.t.**

Figure 12.—**Salix wolfii/Carex aquatilis c.t.** along McCoy Creek in the Caribou Range (2 072 m, 6,800 feet). Organic soils have accumulated near a small spring, and support a low-growing stand of *Salix wolfii* and *Carex aquatilis*. A small stream runs between this community and the *Salix boothii* stand visible in the background.

Salix wolfii/Carex rostrata c.t.
(SAWO/CARO)



DISTRIBUTION.—This is a major type of the study area, and is found most frequently throughout the Greys River drainage. It also apparently extends into central Idaho.

Stands are usually found between 2 010 and 2 620 m (6,600 and 8,600 feet) in elevation on wet alluvial terraces, broad meadows, and some large seeps. Slopes are usually gentle, but the type was sampled on one seep with an 18 percent gradient. Surface topography is usually smooth or undulating. Adjacent riparian c.t.'s within the larger meadow complexes include **Carex rostrata**, **Carex microptera**, and **Deschampsia cespitosa**. *Salix boothii*-dominated c.t.'s may abut this type along streams. Various upland vegetation types may border the seeps or slumps that support this c.t.; these range from dry *Artemisia tridentata* ssp. *vaseyana* types to closed coniferous forests of *Abies lasiocarpa* and *Pinus contorta*.

VEGETATION.—*Salix wolfii* dominates the low shrub canopy. *Betula glandulosa* may occasionally be more abundant than *Salix wolfii*, especially in the Centennial Mountains. *Potentilla fruticosa* and *Salix boothii* may be present in small amounts. The undergrowth is clearly dominated by a dense sward of *Carex rostrata* (fig. 13). *Carex aquatilis* is abundant in all our sample stands except those in the Centennial Mountains. However,

Figure 13.—**Salix wolfii/Carex rostrata c.t.** along the Little Greys River near McCain Guard Station (2 042 m, 6,700 feet). The broad valley bottom supports large patches of *Salix wolfii*, and a dense undergrowth of *Carex rostrata*.

stands where *Carex aquatilis* is more prevalent are keyed elsewhere. Also commonly present, although in small amounts, are *Polemonium occidentale*, *Aster foliaceus*, and *Fragaria virginiana* on raised microsites. This **SAWO/CARO c.t.** lacks the cover of *Pedicularis groenlandica* and mosses that are typical in our **Salix wolfii/Carex aquatilis c.t.**

SOILS.—Soils are derived predominantly from Cretaceous or Jurassic sandstones. Typic Cryaquents and Terric Histosols are the most common taxa (appendix D). Nearly all soils have an organic surface horizon of 5 to 37 cm (2 to 15 inches). Below this, mineral horizons are typically silty clay loam or silt loam in texture, and family particle-size classes are usually fine-loamy, coarse-loamy or clayey. Depth to water table averages 25 cm (10 inches). Profiles are almost always at least moist throughout. Mineral horizons at lower depths are usually heavily mottled or gleyed.

SUCCESSION/MANAGEMENT.—The **SAWO/CARO c.t.** occurs on some of the wettest soils that support *Salix wolfii*. Many of our sites are old beaver ponds that have become filled with silts and clays. Thus, portions of this c.t. resemble the **Carex rostrata c.t.** in terms of development. Presence of a thickened organic horizon is much more characteristic of this c.t. than the **Carex rostrata c.t.** We assume the increased biomass and resulting annual deposition of leaves and twigs of *Salix wolfii* contribute substantially to this layer. Rooting density may also trap more debris. Often, the **Carex rostrata c.t.** borders this **SAWO/CARO c.t.**; in these cases a gradual invasion of *Salix wolfii* may occur as persistent surface water decreases. Once developed, the **SAWO/CARO c.t.** appears relatively stable, with little potential for change in species composition. We believe the thickened organic layer greatly adds to and indicates the community stability. However, as noted for the **Salix wolfii/Carex aqutilis c.t.**, a gradual increase of *Carex aquatilis* may result from increased free oxygen as organic layers build.

Although beaver activity was commonly noted outside our sample stands, we found little indication of beaver use in this **SAWO/CARO c.t.** Big game, especially moose, may browse stands occasionally, but these low stature shrubs are easily covered by snow. Limited production data (appendix C) indicate this type is similar to the **Salix wolfii/Carex aquatilis c.t.**

OTHER STUDIES.—A much broader **SAWO/CARO c.t.** has been described by Norton and others (1981); their type would also include portions of our **Salix wolfii/Carex aquatilis c.t.** Similar communities also apparently exist within central Idaho, and have been referred to as the **Salix/Carex rostrata c.t.** by Tuhy and Jensen (1982).

Salix wolfii/Calamagrostis canadensis c.t. (SAWO/CACA)

DISTRIBUTION.—**The SAWO/CACA c.t.** is a minor type, sampled only in the Cottonwood Creek drainage of the Centennial Mountains. Adjacent communities belong to either **Salix geyeriana/Calamagrostis canadensis**, **Salix boothii/Calamagrostis canadensis**, or other *Salix boothii*-dominated c.t.'s.

VEGETATION.—*Salix wolfii* forms a dense, low overstory. The undergrowth is dominated by a dense sward of *Calamagrostis canadensis*. Other species present may include *Carex rostrata, Bromus ciliatus, Alopecurus alpinus*, and *Senecio sphaerocephalus*.

SOILS.—Limited data suggest these soils are similar to those supporting the **Salix boothii/Calamagrostis canadensis c.t.**, except family particle-size class is clayey.

SUCCESSION/MANAGEMENT.—The dense, uniform canopy of both *Salix wolfii* and *Calamagrostis canadensis* suggests relatively stable conditions. We see little evidence of invasion by other riparian species. This type may be more directly influenced by ground water levels that maintain abundant moisture within the soil profile. Fine textured soil horizons (clays) have high water holding capacity, and may be easily eroded if ground cover is removed.

OTHER STUDIES.—This type has not been described in other studies.

Salix wolfii/Carex nebrascensis (SAWO/CANE)

DISTRIBUTION.—The **SAWO/CANE c.t.** is a minor type of our study area, and was sampled in the Centennial Mountains, Greys River drainage and eastern Wyoming Range. Stands range in elevation from 2 010 to 2 470 m (6,600 to 8,100 feet) and are found on toeslope seeps or alluvial benches adjacent to streams. Surfaces are smooth or undulating.

VEGETATION.—A low, broken canopy of *Salix wolfii* dominates the stands. *Betula glandulosa* may also be present. The undergrowth is dominated by either *Carex nebrascensis* or *Carex simulata*. *Deschampsia cespitosa* is usually present in small amounts. Other common associates include *Aster foliaceus, Pedicularis groenlandica*, and *Polemonium occidentale*.

SOILS.—Limited data indicate a strong correlation between the **SAWO/CANE c.t.** and organic soils. Soils include Sphagnic and Hemic Terric Borofibrists and Histic Cryaquolls. Underlying mineral horizons, when within 1 m of the surface, are usually silt loams or clay loams in texture. Water tables are at the surface.

SUCCESSION/MANAGEMENT.—Thick organic accumulations suggest relatively stable environmental conditions. There is little evidence of succession or retrogression. However, if the lateral movement of water through the profile is restricted, mineralization of the organic matter could increase. At the present time, we suggest management should be similar to that for the **Salix wolfii/Carex aquatilis c.t.**

OTHER STUDIES.—This c.t. has not been described in other studies.

Salix wolfii/Deschampsia cespitosa c.t. (SAWO/DECE)

DISTRIBUTION.—The **SAWO/DECE c.t.** is a minor type found primarily at mid elevations within the Greys River drainage and Wyoming Range of western Wyoming. It occurs on lower toeslopes and benches near small, low gradient perennial streams. Adjacent riparian communities feature *Salix wolfii* and *Carex rostrata* or *Carex aquatilis* on more moist sites, or drier communities dominated by *Artemisia cana* or *Potentilla fruticosa*.

VEGETATION.—A low, relatively dense canopy of *Salix wolfii* dominates the c.t. with *Potentilla fruticosa* usually present. A broad mixture of graminoids may often be overtopped by forbs such as *Aster foliaceus, Helenium hoopesii*, or *Solidago canadensis*. Other forbs commonly present include *Fragaria virginiana, Geum macrophyllum*, and *Polemonium occidentale*. Presence of *Deschampsia cespitosa* should be carefully evaluated to distinguish between this and the **Salix wolfii/Mesic Forb c.t.**

SOILS.—Limited data suggest soils are similar to those of the **Salix wolfii/Mesic Forb c.t.** Family textural-classes are usually coarse- or fine-loamy with moderate to high available water capacity. Presence of many fine mottles throughout the profiles, but especially below 50 cm (20 inches), suggests frequent fluctuation of the water table.

SUCCESSION/MANAGEMENT.—Limited data prevent the development of clear successional hypotheses. Although the presence of *Deschampsia cespitosa* may occasionally indicate sites with little or no previous grazing disturbance, we cannot equate **SAWO/DECE** to the apparently similar **Salix wolfii/Mesic Forb c.t.** along a disturbance sere. Under careful management, this type may provide quality forage for livestock, while under increased pressure, forbs may proliferate. Although management of this minor type may be similar to the more common **Salix wolfii/Mesic Forb c.t.**, our concept of the type within the classification recognizes the

presence of a conspicuous graminoid layer characterized by *Deschampsia cespitosa*.

OTHER STUDIES.—The **SAWO/DECE c.t.** has not been described in other studies.

Salix wolfii/Poa palustris c.t.
(SAWO/POPA)

DISTRIBUTION.—**SAWO/POPA** is a minor type that was sampled only infrequently within the Greys River drainage and the eastern Centennial Mountains. Sites are in close proximity to small perennial streams. Adjacent and more moist riparian communities usually belong to either the **Carex rostrata** or **Carex aquatilis c.t.** Other surrounding types may include **Salix wolfii/Mesic Forb** or **Salix boothii/Carex rostrata**.

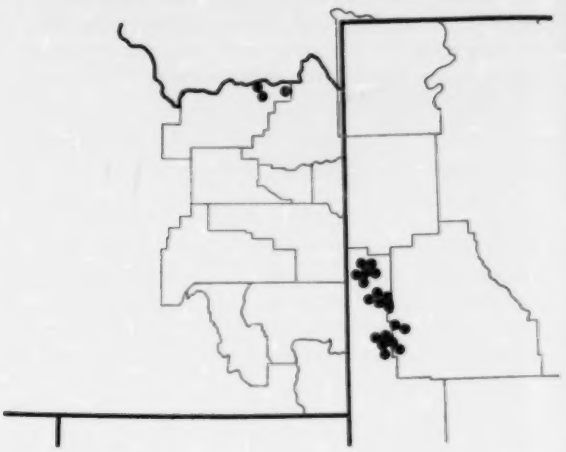
VEGETATION.—Floristically, the **SAWO/POPA c.t.** appears relatively similar to the **Salix geyeriana/Poa palustris c.t.**, with substitution of the low *Salix wolfii*. In addition to *Poa palustris*, the undergrowth may contain small amounts of *Carex aquatilis, Carex microptera, Juncus balticus, Polemonium occidentale*, and *Smilacina stellata*. *Fragaria virginiana* and *Helenium* may be locally abundant.

SOILS.—Soils are either Cryaquolls or Aquic Cryoborolls, with coarse-loamy or fine-loamy family particle-size classes. Water table depths average 47 cm (18 inches), just slightly deeper than the mean for the **Salix geyeriana/Poa palustris c.t.** and almost identical to the **Poa palustris c.t.**

SUCCESSION/MANAGEMENT.—Successional trends are unknown. Until more detailed studies indicate otherwise, we suggest the c.t. be managed in commensuration with **Salix wolfii/Mesic Forb**.

OTHER STUDIES.—This type is not described elsewhere.

Salix wolfii/Mesic Forb c.t.
(SAWO/MF)



DISTRIBUTION.—The **SAWO/MF c.t.** is a major type in the southern portion of our study area, and is especially common within the Greys River drainage. It also occurs in the Centennial Mountains. Stands are found between 1 890 and 2 620 m (6,200 and 8,600 feet) in elevation, on benches or flats adjacent to small Order 1 or 2 streams. Smooth or gently undulating topography is common. Although gentle slopes are prevalent, the type is found on slopes up to 25 percent. **SAWO/MF** communities may be surrounded by a number of other riparian types, including those dominated by *Carex rostrata, Carex aquatilis*, or *Carex microptera* on wetter sites, and the **Salix boothii/Poa pratensis**, **Salix geyeriana/Poa pratensis**, and **Salix boothii/Mesic Forb c.t.** on slightly drier sites. **SAWO/MF** is also found adjacent to *Artemisia cana* stands.

VEGETATION.—A dense canopy of *Salix wolfii* dominates these stands, although small amounts of *Betula glandulosa, Potentilla fruticosa*, and *Ribes inerme* may also be present. Graminoids are relatively inconspicuous, with only *Poa pratensis, Deschampsia cespitosa*, or *Carex microptera* occurring in at least half the sample stands. The undergrowth is clearly dominated by mesic-site forbs; *Fragaria virginiana, Aster foliaceus, Geum macrophyllum, Helenium hoopesii*, and *Polemonium occidentale* are all notable examples.

SOILS.—In general, soils are similar to those supporting the **Salix boothii/Smilacina stellata, Salix boothii/Poa pratensis,** or the **Salix wolfii/Deschampsia cespitosa c.t.** They are typically Aquic, Typic, or Cumulic Cryoborolls, although a few stands are found on Aquents or Fluvents (appendix D). Soil family particle-size classes are usually coarse- or fine-loamy, or loamy-skeletal. Surface horizons are almost always very dark silt loams or loams. Water table depths vary from 35 to over 100 cm (14 to 39 inches) and available water capacity is high.

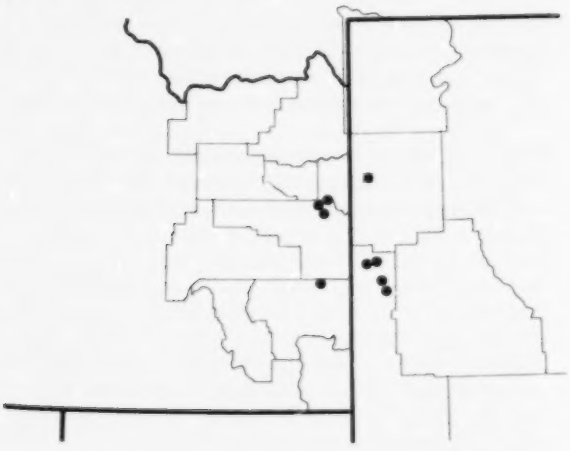
SUCCESSION/MANAGEMENT.—Although **SAWO/MF** communities are often found immediately adjacent to the **Salix wolfii/Carex rostrata** or **Salix wolfii/Carex aquatilis c.t.**, and in other locations are mixed in a mosaic with **Salix boothii/Poa pratensis**, we have little evidence to suggest any successional connection between these types. Most stands belonging to **SAWO/MF** appear relatively stable with little indication of retrogression or progression. There is considerable evidence of disturbance from wild ungulates, beaver, or livestock. This often results in increased cover of disturbance-related species such as *Urtica dioica* and *Cirsium* species. Production values are moderate to high (appendix C), and may be similar to other *Salix wolfii*-dominated types. Little forage is provided for domestic livestock. Soil surface horizons are easily eroded if plant cover is removed.

OTHER STUDIES.—Mutz and Queiroz (1982) briefly described a few sample stands contained within this c.t., and proposed the name **Salix wolfii/Mesic Herb.** Our treatment is designed to provide continuity with similar undergrowth conditions within the **Salix geyeriana/Mesic Forb** and the **Mesic Forb Meadow c.t.**

Other *Salix*-Dominated Community Types

The following group of c.t.'s dominated by *Salix* species are encountered more infrequently and in smaller stands than those named after *Salix boothii, Salix geyeriana,* or *Salix wolfii.* Only the two *Salix exigua* types are relatively major.

Salix exigua/Equisetum arvense c.t. (SAEX/EQAR)



DISTRIBUTION.—The **SAEX/EQAR c.t.** is a major c.t. within the central and southern portions of our study area. Sites are generally below 2 160 m (7,100 feet) in elevation, and are found on alluvial terraces along major streams or rivers where little or no recent fluvial scouring or deposition has taken place. Slopes are usually gentle, and surface topography is either smooth or undulating. Adjacent riparian communities are diverse, and may be dominated by *Picea engelmannii, Cornus stolonifera,* or *Alnus incana.*

VEGETATION.—*Salix exigua* dominates a dense shrub canopy that may also include small amounts of *Cornus stolonifera, Lonicera involucrata, Ribes lacustre, Salix boothii,* and *Salix drummondiana* (fig. 14). *Calamagrostis canadensis* and *Equisetum arvense* may be abundant in the undergrowth. Other associates include *Carex rostrata,* and small amounts of *Poa palustris, Poa pratensis,* and *Geum macrophyllum.* Shrub canopies range from 1 to 2 m tall (3 to 6.5 feet). The undergrowth layer is usually less than 50 cm (20 inches) tall.

SOILS.—This c.t. is supported by a wide variety of soils (appendix D), including Cryaquents, Cryofluvents, and Cryaquolls. In contrast with the **Salix exigua/Poa pratensis c.t.**, most soils have fine earth particle-size classes of fine-loamy or finer; some soils contain more than 35 percent rock fragments. Water tables are near the surface (mean of 25 cm (10 inches) in depth), and most soils contain distinct mottles in the upper 30 cm (12 inches). Available water capacity is moderate.

SUCCESSION/MANAGEMENT.—*Salix exigua* is a pioneering species commonly found along irrigation ditches, cutbanks, and wet areas adjacent to roads. This capacity may prove useful in streambank stabilization and revegetation projects at mid- to lower elevations. The **SAEX/EQAR c.t.** represents communities that apparently have had little recent fluvial action other than occasional and shallow deposition of silts. The presence of abundant rock at depths between 30 and 112 cm (12 and 44 inches) and the presence of *Cornus stolonifera* on about half the sites suggest the development of this **SAEX/EQAR c.t.** following a reduction in fluvial action. Once *Salix exigua* has stabilized the soils, other species such as *Salix boothii, Salix drummondiana, Lonicera involucrata,* and *Ribes lacustre* may become established. Given time, this c.t. is conceivably seral to the **Salix boothii/Equisetum arvense c.t.** Limited data indicate moderate to high annual production. High water tables limit access for livestock.

OTHER STUDIES.—This c.t. has not been previously described. *Salix exigua* is one of the most widely-distributed *Salix* species in North America (Little 1976), therefore, this c.t. may also be shown to occur throughout North America as more riparian ecosystems are classified.

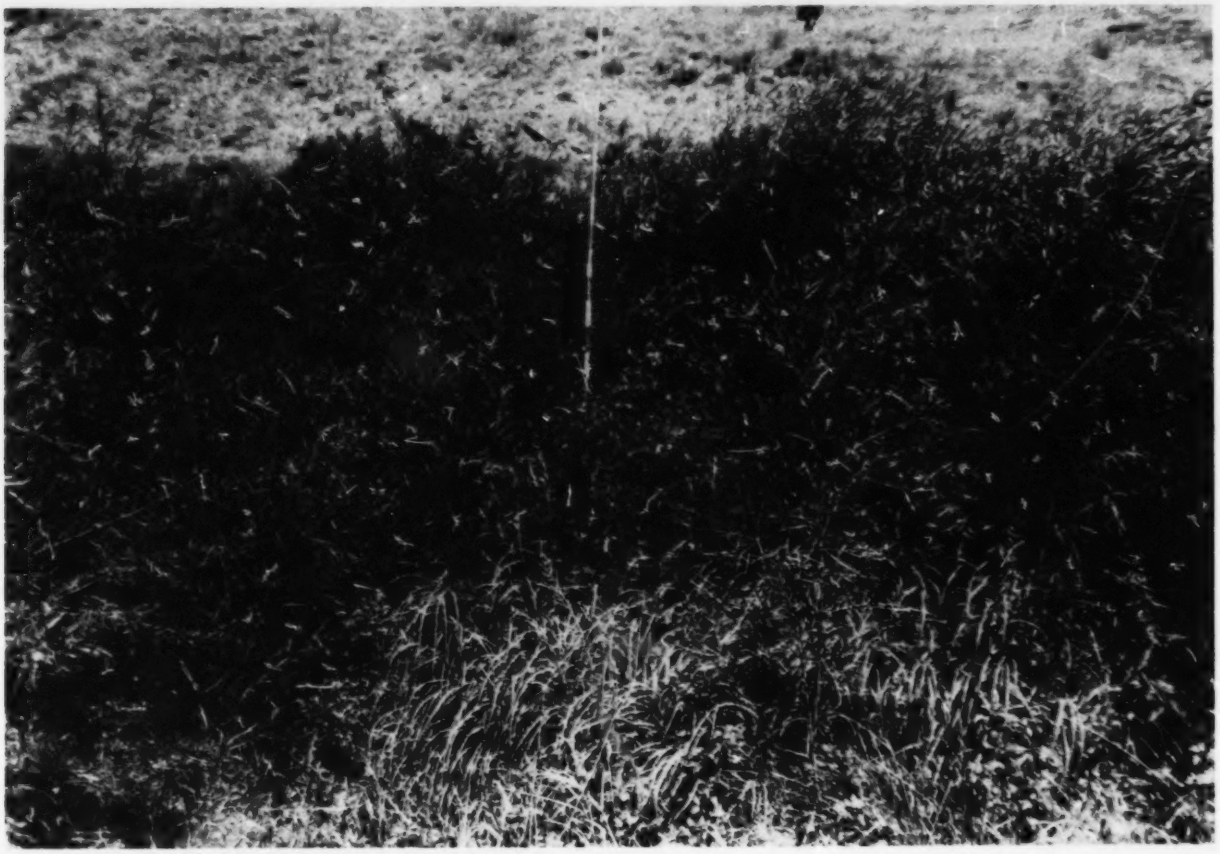
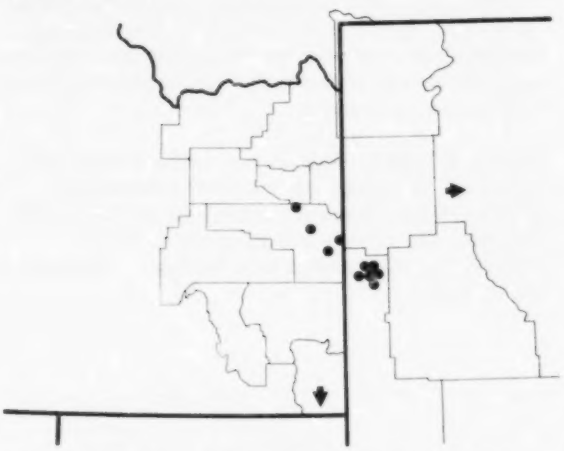


Figure 14.—**Salix exigua/Equisetum arvense c.t.** adjacent to Tincup Creek in the Caribou Range near Pinebar Campground (1 905 m, 6,250 feet). The stand contains *Salix exigua, Salix drummondiana,* and *Rosa woodsii. Calamagrostis canadensis* is conspicuous in the undergrowth.

Salix exigua/Poa pratensis c.t.
(SAEX/POPR)



DISTRIBUTION.—The **SAEX/POPR c.t.** is a major type within the central portion of our study area. It also extends into Oregon, eastern Wyoming, and Utah. Communities are found along streams and rivers within a band or zone experiencing almost seasonal flooding. Elevations are below 2 070 m (6,800 feet). Slopes are all gentle. Adjacent riparian communities are often dominated by either *Alnus incana* or *Cornus stolonifera.*

VEGETATION.—Although *Salix exigua* dominates the overstory, these stands are rarely pure. A diverse mixture of trees and other shrubs are usually present, including small amounts of conifer, *Cornus stolonifera, Lonicera involucrata, Rosa woodsii, Salix drummondiana,* and *Salix lutea.* This stratum usually ranges from 2 to 3 m tall (6.5 to 9.7 feet). The undergrowth is equally diverse. *Poa pratensis* has the highest constancy, but *Agrostis stolonifera, Elymus glaucus, Phleum pratense, Aster foliaceus, Fragaria virginiana,* and *Equisetum hyemale* are also commonly found. Undergrowth cover may vary from dense to sparse.

SOILS.—Soils generally are coarse textured and contain more than 35 percent rock fragments. Common suborders are Fluvents and Aquepts, formed in alluvium derived primarily from Cretaceous sedimentary rock (appendix D). Water tables range from 27 cm to over 1 m (11 to 39 inches) in depth. All of our sample stands are

adjacent to flowing water, and many are at the stream level. Fluvial scouring and annual deposition are common, resulting in coarse textured surface horizons with up to 85 percent bare soil and rock. These provide abundant seedbeds for establishment of annuals such as *Epilobium, Medicago, Trifolium*, or *Poa* species. Available water capacity varies from low to high depending on textures and coarse fragments. The most recently deposited sites may appear as sand or gravel bars; these situations are briefly described under the Unclassified Stands heading (page 56).

SUCCESSION/MANAGEMENT.—The **SAEX/POPR c.t.** is apparently one of our earliest seral stages, and is influenced by the annual dynamics of the stream or river. Under these conditions, *Salix exigua* provides a pioneering function in streambank stabilization through early colonization. Norton and others (1981) suggested, and we concur, that establishment of *Salix exigua* on these sites, and the subsequent lessening of fluvial disturbance, may be necessary for the gradual invasion of other shrubs such as *Salix boothii, Cornus stolonifera*, or *Alnus incana*. A number of other c.t.'s contain significant amounts of *Salix exigua;* **Populus angustifolia/Cornus stolonifera, Alnus incana/Ribes hudsonianum, Cornus stolonifera/Heracleum lanatum, Cornus stolonifera/Galium triflorum, Salix boothii/Equisetum arvense,** and **Salix boothii/Smilacina stellata** may have developed from the **SAEX/POPR c.t.**. The ability to colonize recently disturbed sites suggests the practicality of using *Salix exigua* in riparian revegetation projects.

OTHER STUDIES.—Padgett (1981) described similar communities in eastern Oregon, and discussed the phenology of late anthesis and seed dispersal coincident with low water for *Salix exigua* ssp. *exigua*. Tuhy and Jensen (1982) also found *Salix exigua* communities in central Idaho, but treated them as a minor or incidental type without naming any diagnostic undergrowth. In Wyoming, Norton and others (1981) first described a broad **Salix exigua/Poa pratensis c.t.** for the Greys River. *Salix exigua* communities similar to our stands have also been noted in southeastern Wyoming (Olson and Gerhart 1982). Reconnaissance data indicate this **SAEX/POPR c.t.** is also common in northern Utah.

Salix lutea c.t.
(SALU)

DISTRIBUTION.—The minor **SALU c.t.** is found on gentle alluvial terraces below 2 130 m (7,000 feet). These communities are normally small inclusions within larger *Salix boothii* communities. Stands are either in the eastern Centennial Mountains or the northern portion of the Caribou range. This type may be encountered more frequently south of our study area, as *Salix lutea* is more common throughout Utah (Goodrich 1983).

VEGETATION.—The relatively tall, often almost tree-like *Salix lutea* dominates a diverse overstory. Other shrubs that may be present include *Lonicera involucrata, Ribes lacustre*, and *Salix drummondiana*. Although *Equisetum arvense* is present in all our sample stands (mean of 43 percent) we resisted naming a diagnostic undergrowth species until additional stands are sampled. Other species found in the undergrowth include *Actaea rubra, Angelica arguta, Aster foliaceus, Geranium richardsonii, Saxifraga odontoloma*, and *Senecio triangularis.*

SOILS.—Limited soils data suggest no discernable relationships.

SUCCESSION/MANAGEMENT.—Insufficient data exists to suggest successional relationships or potential management concerns.

OTHER STUDIES.—This c.t. has not been previously described.

Salix planifolia c.t.
(SAPL)

DISTRIBUTION.—The **SAPL c.t.** is a minor type found at low elevations in the Centennial Mountains and the Yellowstone Plateau. It may be more common at high elevations within the Teton Wilderness and the Absaroka Mountains. The type has also been noted in central Idaho and northern Colorado.

VEGETATION.—*Salix planifolia* dominates the low shrub layer. The undergrowth consists of *Carex rostrata, Juncus balticus*, and small amounts of *Pedicularis groenlandica.*

SOILS.—Our sites are all very wet, with either histic epidedons or organic surface horizons over mineral horizons. These are gleyed at or near the upper boundary.

SUCCESSION/MANAGEMENT.—Little is known about successional trends involving *Salix planifolia*. This c.t. appears to be most similar to the **Salix wolfii/Carex rostrata c.t.** in soils and species composition. It may provide important habitat for the common snipe or common yellowthroat (Douglas and Ratti 1984).

OTHER STUDIES.—Similar communities have been described for central Idaho, and named after a codominance of *Carex rostrata* and *Carex aquatilis* (Mutz and Queiroz 1983). These authors refer to the overstory as *Salix phylicifolia* (see Taxonomic Considerations, page 3). Several c.t.'s dominated by *Salix planifolia* have been described from Colorado, but our few sites appear significantly different from the high subalpine to alpine sites noted by Hess and Wasser (1982) and Komarkova (1982).

Salix eastwoodiae c.t.
(SAEA)

DISTRIBUTION.—Communities dominated by *Salix eastwoodiae* are uncommon in our study area, and were found only in the Teton Range south of Yellowstone National Park. *Salix eastwoodiae* becomes more prominent in central Idaho. Our stands are above 2 400 m (7,800 feet), near Order 1 streams or seeps.

VEGETATION.—*Salix eastwoodiae* dominates the relatively tall overstory, with only a few other shrubs such as *Salix drummondiana* or *Lonicera involucrata* present. The undergrowth is forby, and contains small amounts of *Mertensia ciliata*, *Saxifraga odontoloma*, and *Thalictrum occidentale*.

SOILS.—Limited soils data suggest no discernable relationships.

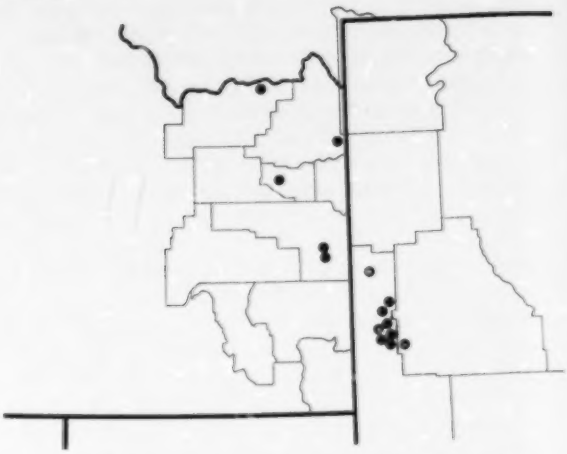
SUCCESSION/MANAGEMENT.—Until further field studies are conducted, we suggest this c.t. be considered similar to the higher elevation extremes of the **Salix boothii/Smilacina stellata c.t.**

OTHER STUDIES.—Communities dominated by *Salix eastwoodiae* have been described for several tributaries of the Salmon River in central Idaho (Tuhy and Jensen 1982, Mutz and Queiroz 1983). The former authors treated *Salix eastwoodiae* as *Salix commutata*. *Carex scopulorum* is a common undergrowth species found by all these authors. The infrequency of these communities presents problems in type definition and description.

Graminoid-Dominated Community Types

The following ten c.t.'s are all dominated by a single graminoid species such as *Carex rostrata*, *Deschampsia cespitosa*, or *Juncus balticus*. As a group, they represent c.t.'s with the lowest species diversity, lowest plant stature or height, and often the highest total annual herbaceous production. A full representation of the moisture gradient is present, ranging from very wet sites supporting *Carex rostrata*, to relatively dry sites supporting *Poa pratensis* and *Phleum pratensis*. There is potential for intense management, such as forage production within the **Deschampsia cespitosa**, **Carex nebrascensis**, **Carex aquatilis**, or **Poa palustris c.t.**. Streambank stability may also be a concern within this group. Soils supporting the **Juncus balticus c.t.** appear much more stable than the highly erosive soils that often support shallow rooting species in the **Poa pratensis c.t.**. Wildlife values are not clearly defined, but normally will be higher for small mammals, reptiles, and amphibians that can tolerate the low structural diversity and cover. Very wet sites supporting the **Carex rostrata**, **Carex aquatilis**, or **Carex simulata c.t.** may be important habitats for the common snipe (Douglas and Ratti 1984).

Carex microptera c.t.
(CAMI)



DISTRIBUTION.—Communities dominated by *Carex microptera* are found throughout the study area, and are especially common within the Greys River drainage. The **CAMI c.t.** is found most often on gently sloping alluvial benches near small Order 1 streams. Elevations range from 1 920 to 2 620 m (6,300 to 8,600 feet). Surface topography is usually smooth to gently undulating. Adjacent riparian c.t.'s include **Carex aquatilis**, **Carex rostrata**, and **Salix wolfii/Carex rostrata** in more moist depressions, and **Deschampsia cespitosa** or the **Mesic Forb Meadow** on drier sites. Boundaries may often be gradual or diffuse.

VEGETATION.—*Carex microptera* is usually the dominant graminoid, but may be mixed with a diverse assemblage of other graminoids and forbs. *Carex rostrata* and *Carex aquatilis* are often present in small amounts, and usually indicate an ecotone with wetter sites. *Deschampsia cespitosa* also has high constancy but low cover, and probably grades into the **CAMI c.t.** from drier sites. *Poa pratensis*, *Aster foliaceus*, *Fragaria virginiana*, *Geum macrophyllum*, and *Helenium hoopesii* all have relatively high constancy but low cover. One single stand contains a high cover of *Heracleum lanatum*, and may be an intergrade with the **Mertensia ciliata c.t.**

SOILS.—Stands are found on a variety of soils (appendix D). Both Typic and Cumulic Cryaquolls are common, but Cryaquents are also encountered. Family particle-size classes include loamy-skeletal, fine-loamy, and clayey. Water tables range from 20 to more than 100 cm (8 to 39 inches); the mean is 49 cm (19 inches). Several profiles contain a buried organic horizon. Available water capacity is usually high.

SUCCESSION/MANAGEMENT.—Little is known about successional trends involving the **CAMI c.t.** It apparently is present in areas that have had various amounts of grazing disturbance. Although Lewis (1958) suggested *Carex microptera* has medium palatability for cattle and

horses and low palatability for sheep, it rarely occurs in large enough areas to warrant close consideration. Limited data indicate total productivity ranges from high to very high, with about equal representation of graminoids and forbs (appendix C). Until more type-specific management prescriptions are developed, the **CAMI c.t.** may be considered similar to the **Deschampsia cespitosa c.t.**

OTHER STUDIES.—The **CAMI c.t.** name has been used for a broad grouping of types in the Greys River area by Norton and others (1980). Our concept separates this **CAMI c.t.** from the **Deschampsia cespitosa**, **Poa pratensis**, and **Mertensia ciliata c.t.'s**.

Carex simulata c.t.
(CASI)

DISTRIBUTION.—The **CASI c.t.** is a minor type found sporadically throughout the Wyoming Range and the Yellowstone Volcanic Plateau. Reconnaissance data indicate this type may extend into forested regions of southcentral Oregon. Similar communities have been noted in central Idaho. Stands range in elevation from 1 770 to 2 560 m (5,800 to 8,400 feet) and are located in broad meadows, on gentle slopes below seeps, and on flat alluvial terraces adjacent to streams. Surface topographies are usually smooth to slightly undulating. Adjacent riparian c.t.'s are usually dominated by graminoids such as *Carex vesicaria* or *Carex atherodes* on wet sites, or *Deschampsia cespitosa* on drier sites. *Carex rostrata* with a *Salix* spp. overstory may also be adjacent; these stands usually belong to the **Salix wolfii/Carex rostrata** or **Salix geyeriana/Carex rostrata c.t.**

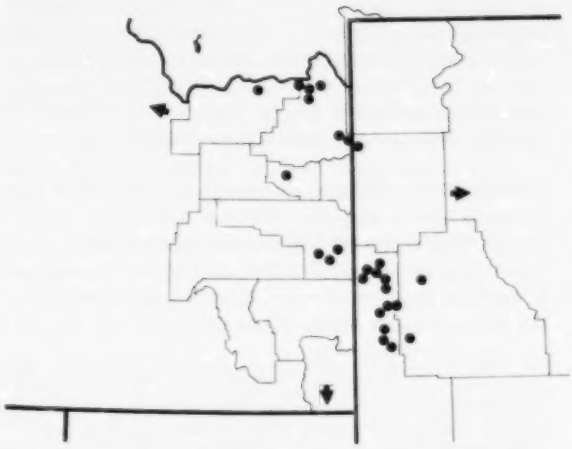
VEGETATION.—A dense sward of *Carex simulata* dominates this c.t. *Carex rostrata, Carex aquatilis, Deschampsia cespitosa*, and *Salix wolfii* may be present, but only in small amounts. The most common forb is *Pedicularis groenlandica*.

SOILS.—Soils are seasonally wet and may have organic surface horizons or thick (cumulic) mollic epipedons. Representative family particle-size classes include fine-loamy and clayey. Water tables range from above the surface to a depth greater than 1 m (39 inches). Distinct or prominent mottles are usually present within the top 50 cm (20 inches) of mineral soil. Available water capacity is moderate to high.

SUCCESSION/MANAGEMENT.—The **CASI c.t.** appears to occupy sites similar to the **Carex aquatilis c.t.**, and should also have a similar successional development. The relatively common occurrence of this c.t. on soils with thickened organic surface horizons suggests a somewhat stable community with little change in species composition from minor fluctuations in water table depths. Annual production, consisting predominantly of graminoids, ranges from moderate to high (appendix C).

OTHER STUDIES.—The presence of *Carex simulata* communities in our study area was first noted by Norton and others (1981) but it was not included as a classified type. Mutz and Graham (1982) found several stands, especially along South Piney Creek in the Wyoming Range. *Carex simulata* communities also occur in central Idaho, where Tuhy and Jensen (1982) listed them as an incidental type.

Carex rostrata c.t.
(CARO)



DISTRIBUTION.—The **CARO c.t.** is a major type within our study area, with stands widely distributed throughout all major drainages and mountain ranges. It is also known to occur elsewhere in Wyoming, Idaho, Colorado, Utah, and Oregon. Stands are found on level benches or flats and gently sloping toeslopes on all aspects. Elevations range from 1 830 to 2 530 m (6,000 to 8,300 feet). Stands are either adjacent to low gradient streams in wide valley bottoms or associated with perennial seeps. Many stands are found where beaver ponds have filled completely with sediment. Most sites have smooth surface topographies. The surface may occasionally be hummocky or mounded; this microtopographic relief often results from a buildup of *Carex* sod and downcutting of small channels by overland flow during spring runoff, or may be remnant channels used by beaver when water tables were higher.

The **CARO c.t.** represents one of the wettest riparian communities; it often borders small meandering streams or open lacustrine systems such as beaver ponds or oxbow lakes. It may occasionally grade into wetland communities dominated by species such as *Carex vesicaria, Carex atherodes* or *Eleocharis palustris*; these stands are briefly described under the Wetland Communities section. Adjacent and drier communities are diverse. With drastically contrasting relief and water table, the driest riparian c.t.'s such as **Artemisia cana/Festuca idahoensis** or upland species such as *Artemisia tridentata* ssp. *vaseyana* may dominate. More often, adjacent riparian communities will support *Salix boothii, Salix*

geyeriana, *Salix drummondiana*, or *Salix wolfii*, with undergrowths nearly identical in their dominance by *Carex rostrata*. When *Salix* species are not present, adjacent communities may be dominated by a variety of drier-site graminoids such as *Carex aquatilis*, *Carex microptera*, *Deschampsia cespitosa*, or *Poa pratensis*. The apparent relationship between these strongly-contrasting c.t.'s and the **CARO c.t.** is discussed under the appropriate type description.

VEGETATION.—*Carex rostrata* is the dominant species and occurs as a dense sward (fig. 15). Species diversity is very low, with most associated species appearing only as scattered incidentals. At the drier extremes *Carex aquatilis* may intergrade, while *Polemonium occidentale* appears to tolerate the more moist extreme. Other species may include *Carex microptera*, *Deschampsia cespitosa*, *Poa pratensis*, and *Geum macrophyllum*. Shrubs are noticeably absent or accidental.

SOILS.—The **CARO c.t.** is apparently influenced more by water table depths than surficial geology, and thus occurs in alluvium derived from diverse geologic substrates. Communities occur on a variety of soil great groups, varying from poorly-developed Cryaquents to deep and well-developed Cryaquolls (appendix D). Family particle-size classes are predominately fine, fine-loamy, or coarse-loamy. A few stands occur on organic substrates; these are classified as either Terric or Typic Histosols. Water tables vary from above the surface to more than 1 m (39 inches) in depth, but average 30 cm (12 inches). Available water capacity is high.

SUCCESSION/MANAGEMENT.—The **CARO c.t.** appears relatively stable. Few species can tolerate the persistent high water tables and competition from *Carex rostrata* on these sites. Once established, *Carex rostrata* should retain its dominance until site factors change significantly. The dense sod formed by numerous coarse, creeping rhizomes is resistant to low energy overland flow of floodwater. Only major changes in fluvial patterns that affect water table depths or cause stream flooding to become more abrasive appear to influence community dynamics. Communities may become more lacustrine, or typically, become drier and support additional graminoids and shrubs. At mid- to high elevations, *Salix wolfii* may become established; these communities are described as the **Salix wolfii/Carex rostrata c.t.** At lower elevations, *Salix boothii* or *Salix drummondiana* may invade as water tables slowly drop; these species may eventually be replaced by *Salix geyeriana*. Resulting communities belong to either the **Salix**

Figure 15.—**Carex rostrata c.t.** along McCoy Creek in the Caribou Basin area of the Caribou Range (1 914 m, 6,280 feet). The narrow drainage bottom is dominated by *Carex rostrata*. A few scattered *Salix boothii* clumps are also present.

boothii/Carex rostrata or **Salix geyeriana/Carex rostrata c.t.** *Carex rostrata* may also invade communities normally found on drier sites, as a result of higher water tables. This may occur following the impoundment of streams by beaver.

Undergrowth production is high to very high, (appendix C), and consists almost entirely of graminoids. Both cattle and horses may occasionally utilize this forage late in the season, although the coarse and tough *Carex rostrata* may be of relatively low palatability. Elk and moose may also graze these sites. The stands have very low stature and structural diversity, and thus may serve as foraging areas for avian species rather than nesting habitat. A recent study of fire effects in a Sierran subalpine meadow dominated by *Carex rostrata* and *Deschampsia cespitosa* (DeBenedetti and Parsons 1984) indicated that fire removed much of the organic accumulation, but that there was little change in plant species composition after four years.

OTHER STUDIES.—A broadly-defined **Carex rostrata c.t.** which also includes our **Carex aquatilis c.t.** has been described for the Greys River area (Norton and others 1980, 1981) and the Wyoming Range (Mutz and Graham 1982). Following the treatment of Mutz and Queiroz (1983) for the Centennial Mountains, we have recognized the difference in soil moisture and grazing potential in stands dominated by *Carex aquatilis*, and treat the **CARO** and **Carex aquatilis c.t.'s** separately. Similar communities have been described for north-central Colorado (Hess and Wasser 1982; Komarkova 1982) although these authors also include *Carex aquatilis* in the association. Other workers have extended the type's distribution through central Utah (Kerr and Henderson 1979) and central Idaho (Schlatterer 1972; Tuhy and Jensen 1982) into Oregon (Seyer 1979; Padgett 1981).

Carex aquatilis c.t. (CAAQ)

DISTRIBUTION.—The **CAAQ c.t.** is a minor type scattered throughout our study area. Previous workers often included it within the **Carex rostrata c.t.**; our refinement of **Carex rostrata** required subsequent elevation of this **CAAQ c.t.** because of contrasting management implications. Within our study area, **CAAQ** is found on smooth, broad flat benches or valley bottoms in close proximity to free, unbound water. Elevations range from 2 010 to 2 620 m (6,600 to 8,600 feet). It may grade into the **Carex rostrata c.t.** with a slight increase in the water table. Drier sites are diverse, and often support *Salix wolfii, Salix boothii, Deschampsia cespitosa* or the **Picea/Galium triflorum c.t.** Like the **Carex rostrata c.t.**, **CAAQ** sites are often silted-in beaver ponds, old oxbow lakes, depressions left by migrating stream channels, or narrow bands close to small streams.

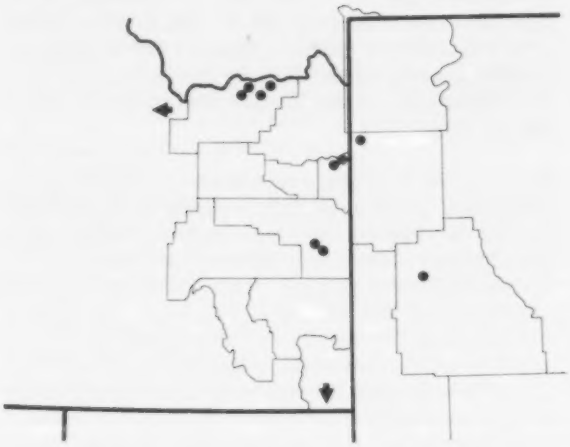
VEGETATION.—This c.t. is named after the dominance of *Carex aquatilis*. Although *Carex rostrata* may often be present, it is clearly subordinate to *Carex aquatilis*. Other species that may occur, usually in small to trace amounts, include *Carex microptera, Poa pratensis, Juncus balticus*, and *Deschampsia cespitosa*. Shrubs and forbs are usually negligible, although a few sampled stands did contain *Aster foliaceus* on drier microsites and *Polemonium occidentale* on more moist depressions.

SOILS.—Like the **Carex rostrata c.t.**, our **CAAQ c.t.** is found on a variety of geologic materials. Soils are often very young or poorly developed, such as Cryaquents or Cryofluvents. A few sample stands in the Centennial Mountains differ in having a deeper mollic epipedon, and heavy clay accumulations. These soils belong to the Cryaquolls. Family particle-size classes are predominately coarse-loamy. Water tables average 36 cm (14 inches) and range from the surface to 80 cm (31 inches) deep. Available water capacity is moderate. Sites lack the thickened organic matter horizons common to the **Salix wolfii/Carex aquatilis c.t.**

SUCCESSION/MANAGEMENT.—Limited data suggest the possible placement of **CAAQ** between **Carex rostrata** and several drier c.t.'s along a successional sere. Similar sites also support *Salix wolfii*; these communities are described as the **Salix wolfii/Carex aquatilis c.t.** Although *Carex aquatilis* is found as an undergrowth to both *Salix boothii* and *Salix geyeriana*, these communities also contain significant amounts of *Carex rostrata* and are named after it. Throughout its distribution, *Carex aquatilis* may be present with great ecotypic variation in growth rate (Chapin and Chapin 1981), but very little difference in photosynthetic rates or optimum temperatures for photosynthesis. This difference may be partially explained by differences in soil fertility (Chapin and Oechel 1983). *Carex aquatilis* is highly palatable to cattle and horses and may provide valuable forage. The **CAAQ c.t.** is believed similar to the **Carex rostrata c.t.** in annual production.

OTHER STUDIES.—The **CAAQ c.t.** was first described by Mutz and Queiroz (1983) for the Centennial Mountains. Our treatment comprises communities previously included in the **Carex rostrata c.t.** described by other workers.

Carex nebrascensis c.t.
(CANE)



DISTRIBUTION.—CANE is a minor, widely scattered type in the study area. Reconnaissance data indicate it may be more common in northern Utah. Communities are found on smooth surfaces on flat or gently sloping, wide meadows and on lower slopes with a variety of aspects. Although a few stands are adjacent to small streams, the high water tables found in this type appear to result from lateral subirrigation rather than fluvial flooding. Elevations range from 1 860 to 2 400 m (6,100 to 7,900 feet). Boundaries with adjacent communities are usually abrupt. Drier sites support communities usually belonging to the **Artemisia cana/Festuca idahoensis**, **Deschampsia cespitosa**, **Poa pratensis**, or **Salix geyeriana/Poa pratensis c.t.**, while the **Carex rostrata c.t.** may be on more moist sites.

VEGETATION.—*Carex nebrascensis* clearly dominates the community. Both *Juncus balticus* and *Deschampsia cespitosa* are usually present in significant amounts. A few stands also contain *Poa palustris*, *Aster integrifolius*, and *Polemonium occidentalis*. Shrubs are generally absent.

SOILS.—Although no apparent relationship exists with geologic parent materials, the **CANE c.t.** does have a strong affinity for well-developed soils with deep mollic epipedons. Family particle-size classes are predominantly fine-clayey over sandy-skeletal or loamy-skeletal, with high water holding capacities. Water tables vary from just above the surface to 60 cm (24 inches) in depth and average 22 cm (9 inches).

SUCCESSION/MANAGEMENT.—**CANE** communities appear intermediate in moisture and succession between **Carex rostrata** and **Deschampsia cespitosa c.t.'s**. *Carex nebrascensis* is a valuable forage species for cattle and horses (Lewis 1958; Hermann 1970) and may also provide cover and food for small game and waterfowl. Our general observations are that these communities are usually highly productive and as a result may have been heavily grazed in the past. Community composition may be altered such that these stands are sometimes classified as belonging to the **Poa pratensis** or **Mesic Forb Meadow c.t.**

OTHER STUDIES.—*Carex nebrascensis* communities were noted by Norton and others (1981) in the Greys River drainage. The **CANE c.t.** was first described by Mutz and Queiroz (1983) from work in the Centennial Mountains of Idaho.

Miscellaneous *Carex* c.t.'s
(CAREX)

DISTRIBUTION.—Limited data suggest the presence of several additional c.t.'s dominated by different species of *Carex*. We have combined these into a single type until additional work resolves their status. They may be found on isolated slumps or as minor components in broad meadows, and often occur near the **Deschampsia cespitosa c.t.** or various wetland communities.

VEGETATION.—*Carex athrostachya, Carex hoodii, Carex praegracilis*, or *Carex lanuginosa* are usually the dominant species. *Carex microptera, Deschampsia cespitosa*, and *Juncus balticus* may be present in small amounts.

SOILS.—Limited soils data suggest the possible association of high water tables and fine textured soils with these *Carex* species. Gleyed horizons are common, often dark grey with brownish-yellow mottles.

SUCCESSION/MANAGEMENT.—Management of these sites should be similar to that for the **Carex simulata c.t.**, although our sample stands typically lack thickened organic accumulations common to **Carex simulata** soil profiles.

OTHER STUDIES.—This c.t. has not been described by other studies.

Juncus balticus c.t.
(JUBA)

DISTRIBUTION.—The **JUBA c.t.** is a minor type scattered throughout the study area. It also occurs in central Idaho and Oregon. Within our study area, the **JUBA c.t.** is usually found on flat to gently sloping alluvial terraces, meadows, and seeps. Surface topography is usually smooth or sometimes undulating. Elevations range from 1 650 to 2 440 m (5,400 to 8,000 feet). The type usually occurs as small inclusions ranging from 0.04 to 0.2 ha (0.1 to 0.5 acres) within larger riparian complexes. Surrounding c.t.'s included **Poa palustris**, **Salix boothii/Poa pratensis**, or **Potentilla fruticosa/Poa pratensis** on drier sites, and **Carex rostrata** or **Carex aquatilis** on more moist sites.

VEGETATION.—*Juncus balticus* dominates the normally dense graminoid stand. Other species present may include *Carex aquatilis, Carex rostrata, Deschampsia*

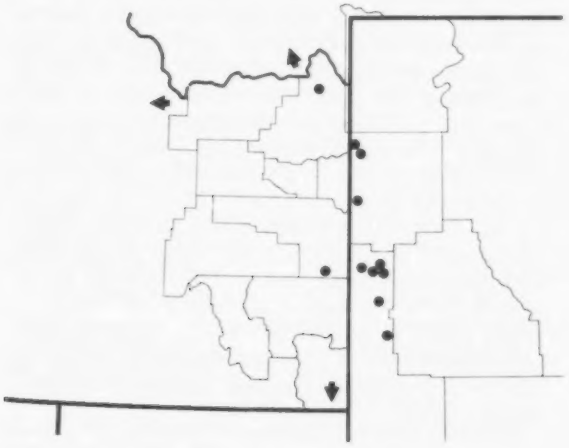
cespitosa, *Phleum alpinum*, and *Poa pratensis*. A diverse mixture of forbs, including *Potentilla gracilis*, *Fragaria virginiana*, and *Aster foliaceus*, may also occur. These usually indicate relatively recent disturbances.

SOILS.—Stands are predominately on thick and well-developed Cryaquolls or Aquic or Calcic Cryoborolls. Family particle-size classes are usually fine-loamy or finer. One stand is on a Terric Histosol. Water tables are variable, and may be deeper than 1 m (39 inches). Available water capacity is high.

SUCCESSION/MANAGEMENT.—*Juncus balticus* is an important forage plant and may provide valuable feed for domestic livestock when young and tender (Hermann 1975). It often is considered an increaser species due to its high tolerance to grazing. Utilization of *Juncus balticus* may be partially responsible for the numerous invader species often associated with it. In other situations, *Juncus balticus* appears to have increased with disturbance, replacing other riparian graminoids. Root systems of *Juncus balticus* are normally very deep and thickly fibrous, with coarse, creeping, often sod-forming rhizomes. It shows a potential for use in streambank stabilization projects because of these soil-holding characteristics. Production is apparently moderate to high (appendix C).

OTHER STUDIES.—Similar communities exist in central Idaho (Tuhy and Jensen 1982) and eastern Oregon (Padgett 1981). Within our study area, the **JUBA c.t.** has been previously described for the Wyoming Range (Mutz and Graham 1982).

Deschampsia cespitosa c.t.
(DECE)



DISTRIBUTION.—The **DECE c.t.** is a major riparian type that occurs throughout the study area. It also can be found in central Idaho, Montana, and Colorado. Reconnaissance data indicate it occurs sporadically throughout higher elevations of northern Utah. Stands are found on nearly level stream terraces and broad meadows. Elevations range from 1 950 to 2 870 m (6,400 to 9,400 feet). Adjacent riparian communities include those dominated by *Carex rostrata* or *Carex aquatilis* on wetter sites, and a broad mixture of herbaceous or shrub-dominated types on drier sites.

VEGETATION.—*Deschampsia cespitosa* usually creates a noticeably dense sward of individual tussocks. Other graminoids may include *Carex aquatilis*, *Carex microptera*, *Carex rostrata*, and *Poa pratensis*. Cover of forbs may range from negligible to almost dominant, with common associates including *Aster foliaceus*, *Potentilla gracilis*, and *Geum macrophyllum*. Shrubs are usually absent.

SOILS.—Soils are usually subirrigated and rarely have standing water. Water tables range from 20 to 100 cm (8 to 39 inches) and average 54 cm (21 inches). Several profiles contain mottles near the surface. Typic or Cumulic Cryaquolls or Aquic Cryoborolls are most frequent (appendix D). Family particle-size classes are usually fine-loamy or clayey, although a few soils contained more than 35 percent rock fragments. Available water capacity is high.

SUCCESSION/MANAGEMENT.—*Deschampsia cespitosa* is an important range species for livestock, however, density may be greatly reduced through continual grazing. Presence of *Poa pratensis* and forbs such as *Helenium hoopesii* and *Potentilla gracilis* may indicate a gradual decrease of *Deschampsia cespitosa* through utilization. Some of our **Poa pratensis** or **Mesic Forb Meadow c.t.** stands may have included more *Deschampsia cespitosa* at one time. Although widely recommended for use in alpine and subalpine mine reclamation and revegetation efforts (Pratt 1982; Brown and Johnston 1980), *Deschampsia cespitosa* shows little potential for use in streambank stabilization projects because of its thin fibrous root structure. Limited sampling in our stands suggests a very high productivity of graminoids (appendix C).

OTHER STUDIES.—*Deschampsia cespitosa* communities have been described within a single **Deschampsia cespitosa/Carex habitat type** in western Montana (Mueggler and Stewart 1980). A **DECE c.t.** very similar to ours has been described for central Idaho (Tuhy and Jensen 1982). In Colorado, several *Deschampsia cespitosa* associations apparently exist; these include *Caltha leptosepala*, *Geum rossii*, and *Sibbaldia procumbens*, and probably represent significantly different subalpine or alpine environments (Bonham and Ward 1970; Hess and Wasser 1982). Franklin and Dyrness (1973) also noted the occurrence of different associations in Oregon and Washington. Within our study area, the **DECE c.t.** was first described by Mutz and Queiroz (1983).

Poa palustris c.t.
(POPA)

DISTRIBUTION.—The **POPA c.t.** is a minor type that occurs infrequently in eastern Idaho. Stands occur from the eastern Centennials south to the Caribou Range, and are all below 1 830 m (6,000 feet) in elevation. Sites are wet toeslopes, alluvial terraces, and flat meadows.

VEGETATION.—*Poa palustris* creates a dense sward. Other graminoids include *Juncus balticus* and *Phleum pratense*. Forbs are clearly subordinate, although *Potentilla gracilis* and *Geum macrophyllum* are usually present. Floristically, this c.t. may sometimes resemble our **Poa pratensis c.t.** without the diagnostic *Poa palustris*.

SOILS.—Stands are found on Typic or Cumulic Cryaquolls with clayey, fine-loamy over sandy-skeletal, or loamy-skeletal particle size classes. Water tables range from 28 to 68 cm (11 to 27 inches). Soils are apparently similar to those found supporting our **Carex microptera c.t.**

SUCCESSION/MANAGEMENT.—*Poa palustris* is a grass introduced from Europe that has become naturalized throughout the western United States. Relatively rapid reproduction is accomplished by rooting at the nodes of decumbent culms, in addition to flowering. It probably has replaced some of our native grasses such as *Deschampsia cespitosa*, although we have no evidence to suggest the possible processes involved in the conversion. Once established, *Poa palustris* appears relatively stable. However, the rooting habit and loamy soils suggest a potential for severe soil loss if ground cover is removed. Streambank stability will also be relatively low.

OTHER STUDIES.—No other studies have described the **POPA c.t.**

Poa pratensis c.t.
(POPR)

DISTRIBUTION.—Our **POPR c.t.** is scattered throughout the study area as a minor type. It also apparently occurs westward into central Idaho and Oregon. Our stands are between 1 770 and 2 130 m (5,800 and 7,000 feet) in elevation and are almost always on smooth, flat to gently sloping terraces adjacent to streams. Neighboring riparian c.t.'s are diverse, and may include the **Salix exigua/Poa pratensis**, **Deschampsia cespitosa**, or **Carex nebrascensis** types.

VEGETATION.—Our concept of the **POPR c.t.** is based upon a lack of other dominant and diagnostic species rather than a relatively pure *Poa pratensis* stand. Therefore, the species diversity within this type is high, and the composition may include small amounts of many of our other diagnostic graminoids. *Poa pratensis* has the highest constancy and usually the highest cover. Other associates include *Phleum pratense*, *Galium boreale*, *Fragaria virginiana*, *Potentilla gracilis*, and *Achillea millefolium*.

SOILS.—Soils are highly variable, and include Aquic Cryofluvents and Pachic Cryoborolls. Other characteristics are not well documented.

SUCCESSION/MANAGEMENT.—Our **POPR c.t.** apparently represents disturbed conditions of other more common c.t.'s. Grazing pressures from livestock probably are responsible for some of our stands, but at least one site in the Caribou Range appeared to have received herbicide application and reseeding. A number of our types, including the **Deschampsia cespitosa**, **Carex microptera**, **Mertensia ciliata**, and **Mesic Forb Meadow c.t.'s**, appear to have the potential for retrogressing to the **POPR c.t.** Once fully established, *Poa pratensis* may be difficult to remove, and may prevent the establishment of native species. As water tables drop, the **POPR c.t.** may gradually be invaded by *Artemisia tridentata* ssp. *vaseyana*. The shallow rhizomatous rooting of *Poa pratensis* and the often loamy soils suggest the potential for severe erosion if ground cover is lost. Streambank stability is usually low.

OTHER STUDIES.—Communities dominated by *Poa pratensis* have been described by Franklin and Dyrness (1973), Hall (1973), and Padgett (1981) for Oregon, and Tuhy and Jensen (1982) in central Idaho. Within western Wyoming, a very broad **POPR c.t.** has been described by Norton and others (1981). Our treatment distinguishes **Deschampsia cespitosa** and **Carex microptera** as separate types, leaving the **POPR c.t.** to represent those communities clearly disturbed by recent activities.

Forb-Cominated Community Types

Three minor c.t.'s are dominated by forbs, with graminoids, trees, or shrubs only incidental or accidental. The **Veratrum californicum** type is relatively moist and is often surrounded by other riparian c.t.'s; **Mertensia ciliata** is often a moist island surrounded by upland types, and the **Mesic Forb Meadow** type is usually transitional to non-riparian communties. These types also differ in their successional status, ranging from relatively stable for the former two c.t.'s, to clearly disturbed for the latter. Although productivity is probably very high throughout, these three c.t.'s present unique livestock management problems. Most wildlife attributes are unknown; only the **Mertensia ciliata c.t.** has species rated suitable for elk forage. Like most other riparian types, these three c.t.'s are dominated by species that reproduce vegetatively, by either rhizomes or a deep woody caudex.

Veratrum californicum c.t.
(VECA)

DISTRIBUTION.—The **VECA c.t.** is a minor type with a sporadic distribution throughout the study area. It also occurs in northern and central Utah. Stands are in wide

meadows within the Caribou and Teton Ranges and average 2 320 m (7,600 feet) in elevation on gentle northern aspects. Adjacent riparian communities usually belong to the **Deschampsia cespitosa, Mesic Forb Meadow,** or **Carex nebrascensis c.t.**, while upland vegetation is dominated by *Abies lasiocarpa*.

VEGETATION.—*Veratrum californicum* provides almost complete ground cover; few other species are present. Occasionally *Deschampsia cespitosa, Aster* species, *Mertensia ciliata*, or *Poa palustris* may occur in small openings.

SOILS.—Surface topography suggests soils have developed in residual or colluvial material in addition to alluvium. Our soils classify to Aeric Ochraqualfs and Aquic Cryoborolls, indicating the degree of in situ development. Water tables are relatively shallow, and water holding capacity is high.

SUCCESSION/MANAGEMENT.—**VECA** communities appear stable or slowly enlarging. Few other species show potential to invade. Production of *Veratrum* may be very high, but is of little value to livestock. Sheep may consume the young shoots and leaves after frost, but generally avoid the plant during the growing season (Dayton 1960). Naturally occurring alkaloids are poisonous to livestock throughout the grazing season, and may cause lambs to be born with congenital deformities of the head (James and others 1980).

OTHER STUDIES.—Similar communities were described by Gregory (1983) for higher elevations on the Bridger-Teton National Forest; she estimated production to exceed 4 000 kg/ha (3,570 pounds/acre). A closely related c.t., consisting of *Veratrum* with minor amounts of *Thalictrum fendleri*, has been described for the Wasatch Plateau in central Utah (Kerr and Henderson 1979).

Mertensia ciliata c.t. (MECI)

DISTRIBUTION.—**MECI** is a minor c.t. that occurs as small islands sporadically throughout the southern portion of the Salt River and Wyoming Ranges. It extends northward into the Centennial Mountains. Stands are relatively high in elevation, and range between 2 400 and 2 720 m (7,900 and 8,900 feet) on all aspects. They occur on benches or flats, or gentle to very steep toeslopes. Most sites are adjacent to streams; one stand was associated with a small seep or spring. Surface topography is either smooth and straight or undulating. Boundaries with adjacent vegetation types are usually abrupt, with strongly contrasting species composition and structure. The **MECI c.t.** is generally within the elevational zone dominated by *Pinus contorta* and *Abies lasiocarpa*; adjacent forested sites may belong to the **Abies lasiocarpa/Ribes montigenum** or **Abies lasiocarpa/Vaccinium scoparium habitat type.** Other upland communities may contain a mixture of shrubs and forbs such as *Artemisia tridentata* ssp. *vaseyana*, *Geranium viscosissimum, Ligusticum filicinum*, or *Thalictrum fendleri*. Adjacent riparian c.t.'s, especially on more gentle slopes or flats, may include **Artemisia cana/Festuca idahoensis, Carex microptera**, or **Salix boothii/Smilacina stellata**.

VEGETATION.—A dense and lush tall forb composition characterizes this c.t. Common species include *Mertensia ciliata, Senecio triangularis, Heracleum lanatum, Geranium richardsonii*, and occasionally *Helenium hoopesii. Saxifraga odontoloma* may be present, especially near perennial seeps and small rivulets. The most common graminoids are *Poa palustris* and *Carex microptera*, although they are usually present in small amounts. Shrubs are accidental.

SOILS.—Soils include Aquic, Cumulic, and Typic Cryoborolls, along with Cryofluvents that resemble Cryoborolls but lack the darkened mollic epipedon. Particle-size classes are predominately loamy-skeletal, sandy-skeletal or coarse-loamy. Site topography and soil characteristics suggest primary development in colluvium, with more recent alluvial influences. Water table depths range from 21 cm (8 inches) to well below the described profile, but in all cases there is evidence of periodic high water. Available water capacity is moderate.

SUCCESSION/MANAGEMENT.—The **MECI c.t.** represents relatively stable vegetation, especially the more upland stands found on toeslopes or near seeps. Sites adjacent to larger streams may be more easily disturbed by fluctuations in ground water levels resulting from stream migration. Although portions of the **Salix boothii/Smilacina stellata c.t.** have a similar forb component, we have no evidence to suggest a possible conversion to or from this type. Disturbance from livestock may result in a gradual change in species composition to include *Rudbeckia occidentalis* and increased amounts of *Helenium hoopesii*. Both *Mertensia ciliata* and *Geranium richardsonii* are utilized by elk as forage. Domestic sheep may find succulent forbs in these communities, with the small size of these often isolated stands encouraging almost complete utilization. The **MECI c.t.** may also be an important indicator of potential slope instability.

OTHER STUDIES.—The **MECI c.t.** has been described by Youngblood (1980), Norton and others (1981), and Gregory (1983) for the Bridger-Teton National Forest. Our treatment maintains earlier concepts.

Mesic Forb Meadow c.t. (MFM)

DISTRIBUTION.—The **Mesic Forb Meadow c.t.** consists of very minor plant communities found primarily in the Centennial Mountains. One stand within the Greys River drainage also keys to this type. The type represents disturbed open meadows that may be transitional to non-riparian types.

VEGETATION.—The **MFM c.t.** is characterized by a diversity of forbs and grasses. Our recognition of this type is based on the kinds of plants present rather than any specific species. Thus, many species indicative of previous disturbance, such as *Potentilla gracilis, Fragaria virginiana, Trifolium repens, Helenium hoopesii, Phleum pratense*, and *Cirsium* species are present. This type also includes many non-riparian species such as *Melica spectabilis, Aster integrifolius*, and *Aster occidentalis*.

SOILS.—Because the **MFM c.t.** represents a broad mixture of sites, our soils and geology data do not present clear relationships. Water tables may be relatively deep, but most profiles contain evidence of periodic upward fluctuation.

SUCCESSION/MANAGEMENT.—Successional relationships are not clearly discernible. In the absence of disturbance, these sites may support the **Deschampsia cespitosa c.t.** or upland vegetation types.

OTHER STUDIES.—Tuhy and Jensen (1982) recognized similar communities in central Idaho as belonging to the **Aster integrifolius-Festuca idahoensis c.t.** Most of our stands have been placed into a dry meadow category named after the presence of *Aster integrifolius* and *Festuca idahoensis* by Mutz and Queiroz (1983). These authors suggest, however, and we agree, that a specific epithet such as *Aster integrifolius* is misleading when no single species has high constancy. We have selected a more generic name to describe this collection of meadow communities.

Wetland Communities

Scattered throughout eastern Idaho and western Wyoming are plant communities associated with persistent standing water. These communities contain plant species that are especially adapted to withstanding anaerobic conditions. In a few cases, the plant communities are composed of several species; most are totally dominated by a single plant species. They often occur as transitional communities between open water lacustrine systems and previously described riparian c.t.'s. Occasionally, the riparian zone may be too narrow to discern, with uplands immediately adjacent. Although several of our typical riparian c.t.'s would also be considered wetlands according to the U.S. Fish and Wildlife Service (Cowardin and others 1979), our description is of communities on sites that are saturated throughout the growing season. They are presented here as a group because of similarity in management.

Nuphar polysepalum is noted throughout the Yellowstone Volcanic Plateau area along the margins of shallow lakes and ponds. Water depth is usually greater than 2 m (6.5 feet). With decreasing depth to lake sediments, *Eleocharis palustris* may occur. *Potamogeton amplifolius* is a common associate. Sites with about 20 to 50 cm (8 to 20 inches) of standing water support dense stands of either *Carex atherodes* or *Carex vesicaria*. These communities are especially common northeast of Ashton, ID. Soils supporting these *Carex* species include Terric Borosaprists, Histic Cryaquolls, and Typic Cryaquepts. Mineral horizons are usually silty loams over clays, and are usually intensely gleyed. *Carex rostrata* usually replaces these species as water depths decrease to the soil surface. Dense stands of *Typha latifolia* are occasionally noted throughout the study area, but were not sampled because of their small size. Finally, *Scirpus acutis* communities are found infrequently and were sampled once in the northern portion of the Caribou Range along Fall Creek near a mineral spring. The soil on this site is classified as a Terric Borohemist, fine-loamy, derived from weathering of travertine deposits. *Scirpus acutis* is more common at lower elevations within the Great Basin where internal drainage and high alkalinity restrict other species.

Unclassified Stands

Less than 5 percent of our sample stands were not classified into one of the previously described community types. Several are found on recently deposited gravel bars and represent the earliest stages of primary succession. Plant cover is minimal, and consists of *Salix* species, *Populus angustifolia, Agrostis stolonifera, Poa pratensis, Medicago lupulina*, or *Epilobium glandulosum*. A single plot in a wet meadow along Bear Trap Creek in the Centennial Mountains is dominated by *Calamagrostis canadensis*, and resembles communities more commonly found in central Idaho (Mutz and Queiroz 1983). A single stand along Rainey Creek near Palisades Reservoir is dominated by *Betula occidentalis* and *Alnus incana*. It also contains ten other tall shrubs and a dense forb component. Although this stand would key to our **Alnus incana/Ribes hudsonianum c.t.**, *Ribes hudsonianum* is lacking, and this stand appears significantly different in terms of site characteristics to warrant separation. Our reconnaissance work indicates similar communities dominated by *Betula occidentalis* are more common in northern Utah. Finally, a number of stands were sampled early in the field season, with graminoid species phenologically immature. The user would normally be able to identify the appropriate community type by revisiting these stands when the indicator species are phenologically more advanced.

INDIVIDUAL ATTRIBUTES OF RIPARIAN COMMUNITY TYPES

Ecological Role of Plant Species

More than 600 plant species were encountered within our riparian sample stands. This seemingly large number of species attests to the variability and floristic diversity within riparian ecosystems. The constancy and average cover data of the most frequently encountered or diagnostic species (appendix B) portray the wide diversity among c.t.'s of our study area. The relative importance of major riparian species within a given c.t.,

along with relative importance throughout their environmental distribution, is also readily apparent. For example, *Carex rostrata* can be found at least occasionally in 25 c.t.'s. However, it is only a relatively important component in six c.t.'s. In contrast, *Rosa woodsii* may occur in 17 c.t.'s, and is usually never more than a minor associate. Comparisons between c.t.'s allow the user to make meaningful predictions about the occurrence of given species. The wide amplitude of *Poa pratensis*, indicated by its presence in all 32 c.t.'s listed, illustrates its low value as an indicator species. Other species such as *Caltha leptosepala* or *Veratrum californicum*, noted for only two c.t.'s, may suggest a particular elevation or soil association. Also readily apparent is the high similarity between undergrowths of several c.t.'s such as **Salix boothii/Carex rostrata** and **Salix geyeriana/Carex rostrata** or **Cornus stolonifera/Galium triflorum** and **Picea/Galium triflorum**.

These data may also be used to determine the most likely c.t. in which to search for a particular species. *Swertia perennis* is found in 17 percent of the **Salix wolfii/Carex aquatilis c.t.** sample stands with an average of 18 percent canopy cover. **Picea/Galium triflorum**, **Picea/Equisetum arvense** or **Salix geyeriana/Poa pratensis** are important c.t.'s for describing the distribution of *Lonicera involucrata*. Appendix B is a condensation of the vegetation component information for each c.t. and reduces the need for lengthy type descriptions.

Productivity

Although not a principal research objective, undergrowth productivity is considered an important management implication of this study. Selected stands were sampled to obtain estimates of total annual forb and graminoid production (standing crop). Results are summarized in appendix C, and are useful in illustrating the wide variability within our major types. For example, despite the high similarity within the **Salix boothii/Carex rostrata c.t.** based upon floristic attributes, the amount of bare ground, litter, and water may range from near zero to almost eighty percent. Sample stands have been influenced by recent disturbances such as grazing, fire, or changes in water tables. These data do not, therefore, represent the potential maximum production of these sites. They do, however, indicate general characteristics. As resource management within the riparian zone intensifies, and herbage production opportunities are maximized, emphasis on riparian forage rather than on less productive upland communities may lead to additional management conflicts.

Soils

Characteristics of the upper 1 m (39 inches), or depth to a restrictive layer of stone or cobble if less than 1 m, are summarized in appendix D. Soil sampling was designed to allow simple and preliminary characterization of the surface soils for the major c.t.'s rather than detailed soil-vegetation investigations. However, a number of apparent relationships are suggested by the limited data available. Many c.t.'s within our study area appear to be correlated with soil particle-size. These trends are discussed in the group or c.t. descriptions. Of particular interest is the predominance of major, widespread types, such as **Salix boothii/Carex rostrata**, **Salix wolfii/Carex rostrata**, **Salix geyeriana/Carex rostrata**, **Salix geyeriana/Poa palustris**, and **Carex rostrata** on fine substrates. In contrast, **Picea/Galium triflorum**, **Cornus stolonifera/Galium triflorum**, **Salix boothii/Equisetum arvense**, **Salix exigua/Equisetum arvense**, and **Salix exigua/Poa pratensis c.t.'s** often occur on sites with coarse substrates. Although these data are from limited sample sizes and are not intended to replace site-specific soil surveys, they do produce a generalized concept of riparian soil conditions for most c.t.'s.

Although bedrock and surficial geology were determined for each sample stand, we were unable to derive any meaningful correlation. We attribute this failure to the wide array of geological substrates present in the overthrust region of eastern Idaho and western Wyoming.

Water table depths and available water capacity are useful in deriving management implications. We have no basis, however, for suggesting any direct relationship between water table and water availability for plant uptake. Specific soil studies of clay mineralogy and water potential relationships need to be performed. Our fieldwork does suggest a gradient of oxygen availability and its effect on species distribution.

SUCCESSIONAL RELATIONSHIPS OF COMMUNITY TYPES

Succession is the partial or complete change in vegetation of a given area through the replacement of one plant community by another. Primary succession may be initiated following alluvial erosion, deposition, landslides, or lava flows, and is strongly influenced by plant colonization. Models describing this process call it facilitative succession (Connell and Slatyer 1977) because early successional species must prepare the site for later species. Later species must await the dominance and demise of the earlier inhabitants and the development of suitable substrates.

Secondary succession refers to the process whereby change occurs on sites previously vegetated. This process may be initiated by fire, herbivory, windstorms, pathogens, or mechanical or chemical manipulation by humans. Numerous models have been proposed to describe the pattern of secondary succession. One model assumes a competitive hierarchy because later successional species are capable of invading the earliest sites and tolerating lower levels of resources. In contrast, the chronic and patchy disturbance or 'inhibition' model suggests that disturbances are frequent and early colonists quickly dominate and inhibit all other species (Connell and Slatyer 1977).

Although description of successional relationships within the riparian ecosystem was listed as a major objective of this study, our study design of reconnaissance plot sampling prevented in-depth evaluations of changes in species composition for any single site. Rather, we have utilized observations of different communities, which we assume represent a significant portion of the time and space continuum. Our hypothesized successional relationships have been generated through inferences of individual species' ecological amplitudes and soil development leading to increasing depth, organic content, and differentiation of layers. Our concept of stability is oriented toward resource management; community types considered stable imply a self-perpetuation of species with little change in composition expected within the foreseeable future, given existing environmental or land-use conditions. Theoretically, climax conditions within the riparian ecosystem may not be obtainable given the periodic fluctuations of environmental conditions. Thus, a concept of succession toward climax is inappropriate. Our best hypothesis of successional relationships for major community types is presented in fig. 16. The linear sequence displayed is not intended to imply a deterministic model; exceptions to the indicated trends can be found. These are intended to suggest possible sequences according to two contrasting geomorphological types, starting with either recent deposition associated with moving water or gradual deposition of sediments and receding of standing water. Directional processes from one community type to another indicate succession; we have not attempted to indicate the many possible relationships resulting from retrogression.

Primary succession, following development of a gravel bar (part A of fig. 16), appears to proceed rapidly. Many riparian species are able to colonize those sites in which nutrients and sometimes even moisture appear to be limiting resources. As previously noted, *Salix exigua* may be an early colonizer, and may provide sufficient site protection for the later establishment of species such as *Salix boothii, Cornus stolonifera*, or *Equisetum arvense*. However, shallow-rooted seedlings may be eliminated by frequent inundation, additional sediment deposition, or erosion. Soil particle-size distribution and oxygen availability may also influence species establishment. Gradually, sufficient alluvium may accumulate along the stream terrace, or stream downcutting may be rapid, such that flooding may no longer control species composition. Changes in the stream course may result in short periods during which newly-established shrubs are not washed out by flooding, allowing mature roots to thicken and hold soil and increase streambank stability. This stage may be represented by our **Cornus stolonifera/Heracleum lanatum**, **Cornus stolonifera/Galium triflorum**, or **Salix boothii/Equisetum arvense c.t.** Conversion to either **Picea/Equisetum arvense** or **Salix boothii/Smilacina stellata** may be a lengthy process.

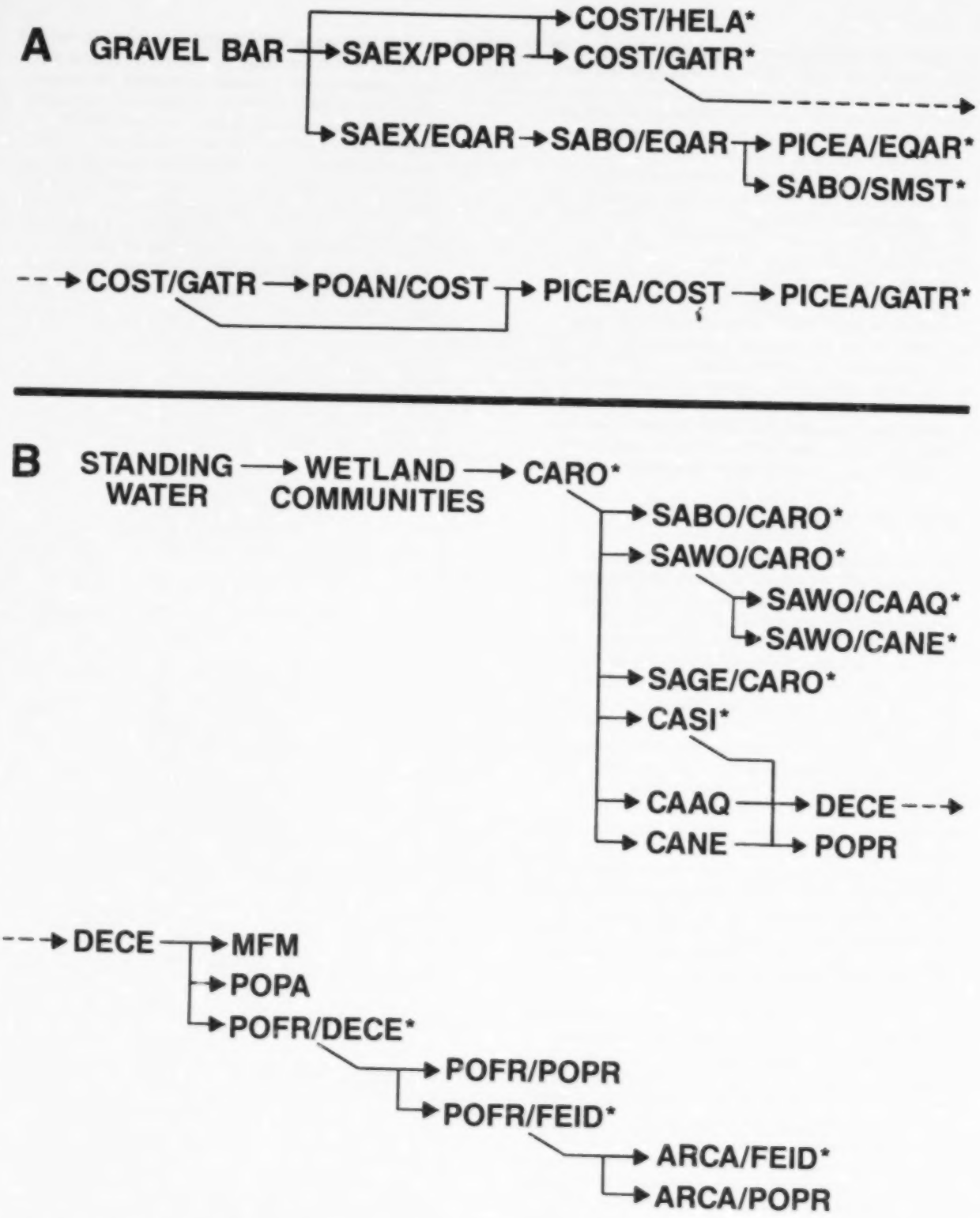
Conversion from **Cornus stolonifera/Heracleum lanatum** to types supporting either *Populus angustifolia* or *Picea* species appears to represent much of the change along major rivers. Invasion of trees into the dense shrub thickets may be influenced by the availability of seedbed sites resulting from patchy or localized disturbances. There is also an apparent increase in fine textured surface soils as communities become less susceptible to flooding, and organic matter is incorporated into the soil. Development of mature *Picea* stands may take 100 to 200 years. The **Picea/Galium triflorum c.t.** is considered stable, because species such as *Picea engelmannii* or *Picea pungens* may be self-perpetuating through seedling establishment on downed logs and root balls overturned by wind.

Succession in lentic systems (part B of fig. 16) appears to be at least partially controlled by available oxygen. Beaver ponds in small streams or natural impoundments may eventually support a narrow band of aquatic plants that help accumulate sediments. As organic material accumulates, floating mats of wetland species develop. Our **Carex rostrata c.t.** represents communities commonly found grading into the wetland communities. Vigorous reproduction of *Carex rostrata* may inhibit many other species, suggesting a stable c.t. on sites with deep organic accumulations. In other situations, environmental fluctuations prevent the continual accumulation of *Carex rostrata* material, and other opportunistic species may become established. Some situations, such as within the **Salix boothii/Carex rostrata** or **Carex nebrascensis c.t.** may also be relatively stable. At other times, these communities may still be changing, and show potential for development into c.t.'s common in the broad valley bottoms or meadows.

A final group of c.t.'s is representative of changes from the moist or mesic meadows to relatively dry, upland sites. A controlling soil process may be the continual decrease in water tables leading to a gradual increase in soil development as expressed by soil structure. Some of our sites even contain argillic horizons, indicating the slow weathering and translocation of clay particles.

RELATIONSHIP TO PREVIOUS RIPARIAN CLASSIFICATIONS WITHIN THE STUDY AREA

The evolution of a riparian community type classification for eastern Idaho and western Wyoming has been a slow process, with a gradual development and refinement of concepts and terminology. This classification incorporates previous work from portions of the study area. Although we considered each individual classification following the original work of Norton and others (1980) as a subsequent approximation with greater refinement of type concepts, the different data bases were combined with no attempt to maintain their original disposition. In general, the increase in sample plot



***Denotes potentially stable community type.**

Figure 16.—Hypothesized successional relationships for major riparian community types of eastern Idaho and western Wyoming.

numbers over a larger area allowed the description of more community types. Some of these plots had been grouped into various miscellaneous community types by different workers. Our efforts in combining all data allowed these plots to surface as recognizable types; these include the **Populus angustifolia/Poa pratensis**, **Populus angustifolia/Cornus stolonifera**, **Salix wolfii/Carex rostrata**, **Salix wolfii/Carex aquatilis**, and **Salix wolfii/Carex nebrascensis c.t.'s.** In other cases, our classification includes additional c.t.'s, such as **Picea/Cornus stolonifera**, **Cornus stolonifera/Heracleum lanatum**, **Cornus stolonifera/Galium triflorum**, **Salix geyeriana/Poa pratensis**, or **Salix wolfii/Deschampsia cespitosa**, necessary to handle contrasting successional stages and management emphases. Finally, sampling of new and different environments resulted in the description of additional types, including the **Rhamnus alnifolia**, **Salix boothii/Carex nebrascensis**, **Salix eastwoodiae**, and **Veratrum californicum c.t.'s** and the wetland communities. These relationships are presented in figure 17.

USE OF CLASSIFICATION

This classification attempts to provide a natural stratification of the riparian vegetation and riparian ecosystems of eastern Idaho and western Wyoming. The classification is based on the existing vegetation regardless of successional status or disturbance level. The goal of this classification effort was to develop community types that are meaningful and useful to the resource manager who may be concerned with management practices and their consequences within the riparian ecosystem. We consider this classification extensive and comprehensive, because it is based on a wide geographic area, several years' work, and a relatively high number of sample stands. However, no classification is ever complete; additional situations may exist and warrant description. These will become apparent only through validation of the classification after extensive application. Users may forward recommendations for further refinement to the Regional Ecology and Classification Program, Range and Watershed Management, Forest Service, U. S. Department of Agriculture, 324 25th Street, Ogden, UT 84401.

Perhaps the most significant aspect of this classification is delineation of riparian ecosystems for the mountainous portions of eastern Idaho and western Wyoming. Resource managers now have a tool for identifying, in a field situation, the existence of the riparian zone and the ecotone between it and terrestrial communities. This classification allows the resource manager to more accurately determine the distribution and relative amounts of riparian communities for the area of concern. Furthermore, the resource manager has a tool for describing riparian resources and communicating concepts relating to riparian community types for a variety of users through a single common classification.

At a broader scale, our classification portrays the diversity of communities, successional patterns, and site characteristics within riparian ecosystems of eastern Idaho and western Wyoming. It provides an inventory of the major plant species, insights into the relative amplitudes of common riparian species, a basis for approach to the study of successional relationships, and a basis for presentation of wildlife and range values and changes following disturbances. Finally, as a stratification tool, the classification may serve as a framework for additional research into the relationships between streambank stability and fisheries, forage production and wildlife habitat, and structural characteristics and natural fire intervals.

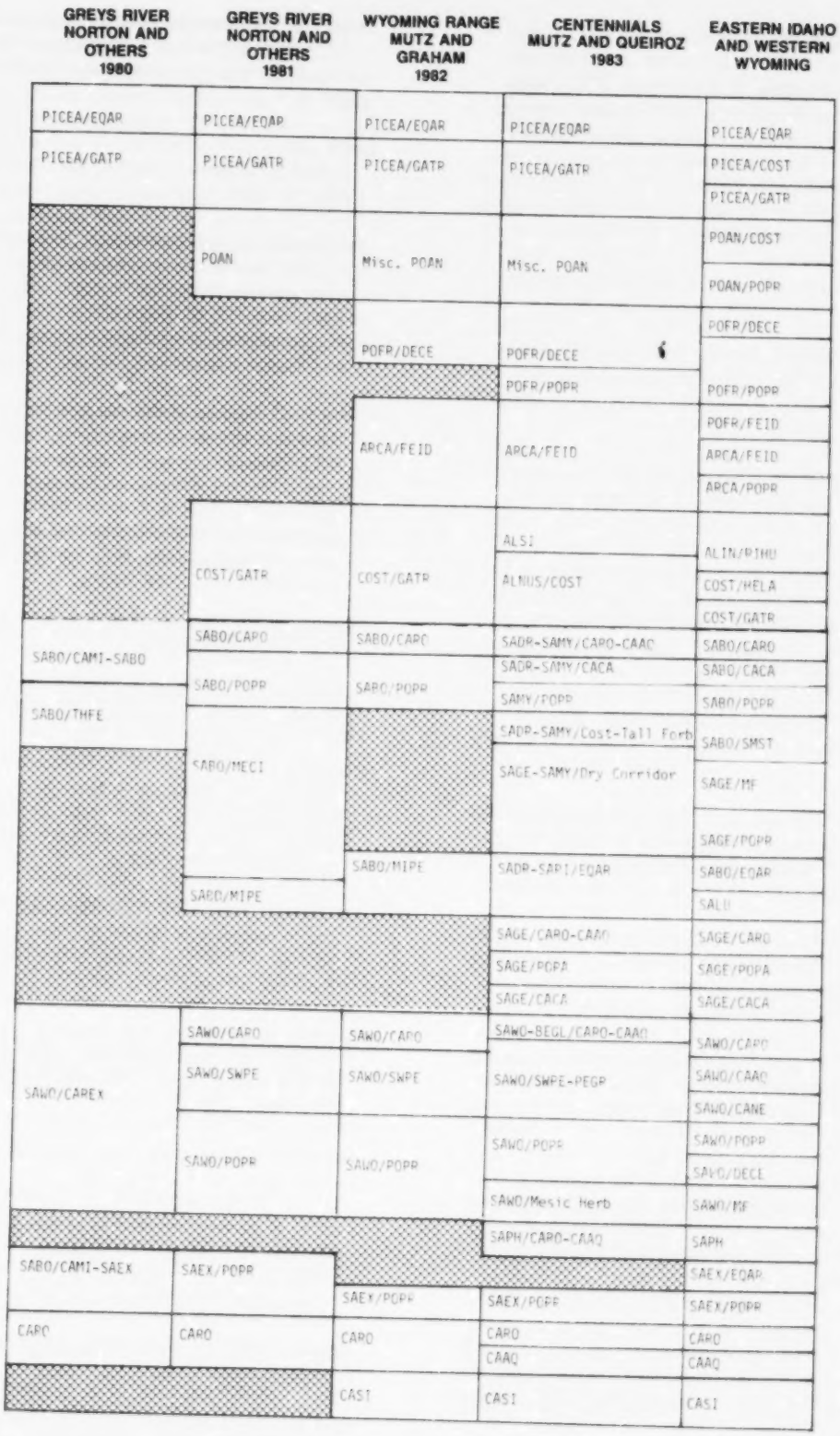


Figure 17.—Relationship with previous riparian community type classifications in Idaho and Wyoming.

REFERENCES

Anderson, B. W.; Higgins, A. E.; Ohmart, R. D. Avian use of saltcedar communities in the lower Colorado River Valley. In: Importance, preservation and management of riparian habitat: a symposium. Gen. Tech. Rep. RM-43. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station; 1977: 128-136.

Baker, F. S. Mountain climates of the western United States. Ecol. Monographs. 14: 223-254; 1944.

Bonham, C. D.; Ward, R. T. Phytosociological relationships in alpine tufted hairgrass (*Deschampsia caespitosa* (L.) Beauv.) meadows. Arctic and Alpine Research. 2: 267-275; 1970.

Bramble-Brodahl, M. K. Classification of *Artemisia* vegetation in the Gros Ventre area, Wyoming. Moscow, ID: University of Idaho; 1978. 126 p. Thesis.

Brown, R. N.; Johnson, R. S. Bioassay of alpine mine spoils for plant growth and development. Res. Note INT-285. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1980. 11 p.

Campbell, C. J. Ecological implications of riparian vegetation management. J. Soil and Water Cons. 25: 49-52; 1970.

Chapin, F. S., III; Chapin, M. C. Ecotypic differentiation of growth processes in *Carex aquatilis* along latitudinal and local gradients. Ecology. 62: 1000-1009; 1981.

Chapin, F. S., III; Oechel, W. C. Photosynthesis, respiration, and phosphate absorption by *Carex aquatilis* ecotypes along latitudinal and local environmental gradients. Ecology. 64: 743-751; 1983.

Connell, J. H., Slatyer, R. O. Mechanisms of succession in natural communities and their role in community stability and organization. Amer. Natur. 111: 1119-1144; 1977.

Cowardin, L. M.; Carter, V.; Golet, F. C.; LaRoe, E. T. Classification of wetlands and deep water habitats of the United States. FWS/OBS-79/31. Washington, DC: U.S. Department of the Interior, Fish and Wildlife Service; 1979. 103 p.

Cronquist, A.; Holmgren, A. H.; Holmgren, N. H.; Reveal, J. L.; Holmgren, P. K. Intermountain flora: vascular plants of the Intermountain West, U.S.A. Vol. 6. New York: Columbia University Press; 1977. 584 p.

Daubenmire, R. Plant communities: a textbook of plant synecology. New York: Harper and Row; 1968. 300 p.

Dayton, W. A. Notes on western range forbs: Equisetaceae through Fumariaceae. Washington, DC: U.S. Department of Agriculture, Forest Service; 1960. 254 p.

DeBenedetti, S. H.; Parsons, D. J. Postfire succession in a Sierra subalpine meadow. Am. Midl. Nat. 111: 118-125; 1984.

Dick-Peddie, W. A.; Hubbard, J. P. Classification of riparian vegetation. In: Importance, preservation and management of riparian habitat: a symposium. Gen. Tech. Rep. RM-43. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station; 1977: 85-90.

Dorn, R. D. Manual of the vascular plants of Wyoming. Vol. I and II. New York: Garland Publishing, Inc.; 1977. 1498 p.

Douglas, D. C.; Ratti, J. T. Avian habitat associations in riparian zones of the Centennial Mountains and surrounding areas, Idaho. Pullman, WA: Washington State University; 1984. 125 p.

Esau, K. Anatomy of seed plants. New York: John Wiley and Sons; 1977. 550 p.

Fenneman, N. M. Physiography of western United States. New York: McGraw-Hill; 1931. 534 p.

Franklin, J. F.; Dyrness, C. T. Natural vegetation of Oregon and Washington. Gen. Tech. Rep. PNW-8. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station; 1973. 417 p.

Gerhart, W. A.; Olsen, R. A. Handbook for evaluating the importance of Wyoming's riparian habitat to terrestrial wildlife. Cheyenne, WY: Wyoming Game and Fish Department; 1982. 91 p. Unpublished.

Gregory, S. Subalpine forb community types of the Bridger-Teton National Forest, Wyoming. Bozeman, MT: Montana State University; 1983. 97 p. Unpublished.

Goodrich, S. Utah flora: Salicaceae. Great Basin Naturalist. 43: 531-550; 1983.

Hall, F. C. Plant communities of the Blue Mountains in eastern Oregon and southwestern Washington. R-6 Area Guide 3-1. Portland, OR: U.S. Department of Agriculture, Forest Service; 1973. 62 p.

Hanson, H. C. Dictionary of ecology. New York: Philosophical Library, Inc.; 1962. 382 p.

Hermann, F. J. Manual of the Carices of the Rocky Mountains and Colorado Basin. Ag. Handb. 374. Washington, DC: U.S. Department of Agriculture, Forest Service; 1970. 397 p.

Hermann, F. J. Manual of the rushes (*Juncus* spp.) of the Rocky Mountains and Colorado Basin. Gen. Tech. Rep. RM-18. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station; 1975. 107 p.

Hess, K.; Wasser, C. H. Grassland, shrubland, and forestland habitat types of the White River-Arapaho National Forest. Final Report to Region II, U.S. Department of Agriculture, Forest Service, Region II. 1982. 335 p. Unpublished.

Hill, M. D.; Gauch, H. G., Jr. Detrended correspondence analysis: an improved ordination technique. Vegetatio. 42: 47-58; 1980.

Hironaka, M.; Fosberg, M. A.; Winward, A. H. Sagebrush-grass habitat types of southern Idaho. Bull. No. 35. Moscow, ID: University of Idaho, Forest, Wildlife and Range Experiment Station; 1983. 44 p.

Hitchcock, C. L.; Cronquist, A. Flora of the Pacific Northwest. Seattle, WA: University of Washington Press; 1973. 730 p.

Hubbard, J. P. Importance of riparian ecosystems: biotic considerations. In: Importance, preservation and management of riparian habitat: a symposium. Gen. Tech. Rep. RM-43. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station; 1977: 14-18.

James, L. F.; Keeler, R. F.; Johnson, A. E.; Williams, M. C.; Cronin, E. H.; and Olsen, J. D. Plants poisonous to livestock in the western states. Ag. Info. Bull. 415. Logan, UT: U.S. Department of Agriculture, Science and Education Administration; 1980. 90 p.

Jensen, M. E. Soil temperature-elevation relationships in southern Idaho and western Wyoming wildlands. Soil Science. 137: 47-51; 1984.

Jobin, D.A.; Soister, P.E. Geologic map of the Thompson Peak quadrangle, Bonneville County, Idaho. Mineral investigations field studies map MF-284. Washington, DC: U.S. Department of the Interior, Geologic Survey; 1964.

Johnson, R. R; Haight, L. T.; Simpson, J. M. Endangered species vs. endangered habitats: a concept. In: Importance, preservation and management of riparian habitat: a symposium. Gen. Tech. Rep. RM-43. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station; 1977: 68-79.

Kerr, C. W.; Henderson, J. A. Upland vegetation classification and map for a test area, Manti-LaSal National Forest. Appendix Report 13. In: Henderson, J. A.; Davis, L. S., Ryberg, E. M., eds. ECOSYM: a classification and information system for wildland resource management. Logan, UT: Utah State University; 1979. 128 p.

Knight, R. R.; Blanchard, B. M. Yellowstone grizzly bear investigations, annual report of the interagency study team, 1982. Bozeman, MT: U.S. Department of Interior, National Park Service; 1983. 45 p. Unpublished.

Kormarkova, V. Habitat types on selected parts of the Gunnison and Uncompahgre National Forests, first approximation. Progress report No. 2 to U.S. Department of Agriculture, Forest Service, Region II. 1982. 206 p. Unpublished.

Lewis, M. E. *Carex*-its distribution and importance in Utah. Brigham Young University Science Bull., Biological Series Vol. I, No. II. Provo, UT: Brigham Young University; 1958. 43 p.

Likens, G. E.; Bormann, F. H. Linkages between terrestrial and aquatic ecosystems. Bioscience. 24: 447-456; 1974.

Little, E. L., Jr. Atlas of United States trees. Vol. 3. Minor western hardwoods. Misc. Pub. 1314. Washington, DC: U.S. Department of Agriculture, Forest Service; 1976. 13 p., 290 maps.

Love, J. D.; Reed, J. C., Jr.; Christiansen, R. L.; Stacy, J. R. Geologic block diagram and tectonic history of the Teton region, Wyoming-Idaho. Map 1-730. Washington, DC: U.S. Department of the Interior, Geologic Survey; 1972.

Mauk, R. L.; Henderson, J. A. Coniferous forest habitat types of northern Utah. Gen. Tech. Rep. INT-170. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1984. 89 p.

McGuire, J. R. Position paper: a riparian policy for changing times. In: Strategies for protection and management of floodplain wetlands and other riparian ecosystems: a symposium. Gen. Tech. Rep. WO-12. Washington, DC: U.S. Department of Agriculture, Forest Service; 1977: 137-145.

Meehan, W. R.; Swansen, F. J.; Sedell, J. R. Influences of riparian vegetation on aquatic ecosystems with particular reference to salmonid fishes and their food supply. In: Importance, preservation and management of riparian habitat: a symposium. Gen. Tech. Rep. RM-43. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station; 1977: 137-145.

Mueggler, W. F.; Campbell, R. B., Jr. Aspen community types on the Caribou and Targhee National Forests in southeastern Idaho. Res. Pap. INT-294. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1982. 32 p.

Mueggler, W. F.; Stewart, W. L. Grassland and shrubland habitat types of western Montana. Gen. Tech. Rep. INT-66. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1980. 154 p.

Mueller-Dombois, D.; Ellenberg, H. Aims and methods of vegetation ecology. New York: John Wiley and Sons; 1974. 547 p.

Mutz, K. M.; Graham, R. Riparian community type classification-Big Piney Ranger District, Wyoming. Contract No. 53-84M8-1-974. Layton, UT: Meiiji Resource Consultants; 1982. 88 p. Unpublished.

Mutz, K. M.; Queiroz, J. Riparian community classification for the Centennial Mountains and South Fork Salmon River, Idaho. Contract No. 53-84M8-2-0048. Layton, UT: Meiiji Resource Consultants; 1983. 170 p. Unpublished.

Norton, B. E.; Urness, P. J.; Southard, A. R.; Young, R. P. A riparian community classification study, final report. Logan, UT: Utah State University; 1980. 77 p. Unpublished.

Norton, B. E.; Tuhy, J.; Jensen, S. Riparian community classification for the Greys River, Wyoming. Logan, UT: Department of Range Science, Utah State University; 1981. 188 p. Unpublished.

Odum, E. P. Ecological importance of the riparian zone. In: Strategies for protection and management of floodplain wetlands and other riparian ecosystems. Gen. Tech. Rep. WO-12. Washington, DC: U.S. Department of Agriculture, Forest Service; 1979: 2-4.

Olsen, R. A.; Gerhart, W. A. A physical and biological characterization of riparian habitat and its importance to wildlife in Wyoming. Cheyenne, WY: Wyoming Game and Fish Department; 1982. 188 p. Unpublished.

Padgett, W. G. Ecology of riparian plant communities in southern Malheur National Forest. Corvallis, OR: Oregon State University; 1981. 143 p. Thesis. Unpublished.

Papeyan, E. H.; Schroeder, M. L.; Schell, E. M.; Cressman, E. R. Geologic map of the Driggs quadrangle, Bonneville and Teton Counties, Idaho and Teton County, Wyoming. Mineral investigations field studies map MF-300. Washington, DC: U.S. Department of the Interior, Geologic Survey; 1967.

Pase, C. P.; Layser, E. F. Classification of riparian habitat in the southwest. In: Importance, preservation and management of riparian habitat: a symposium. Gen. Tech. Rep. RM-43. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station; 1977: 5-9.

Peterson, R. M. Riparian management on the National Forest System. Fisheries. 8: 22-25; 1983.

Pfister, R. D.; Kovalchik, B. L.; Arno, S. F.; Presby, R. C. Forest habitat types of Montana. Gen. Tech. Rep. INT-34. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1977. 174 p.

Pratt, P. E. An evaluation of *Deschampsia caespitosa* (L.) Beau. populations for multimetal tolerances and ecotypic variation of Climax, Colorado. Logan, UT: Utah State University; 1982. 53 p. Unpublished.

Prostka, H. J.; Hackman, R. J. Preliminary geologic map of the NW Driggs 1° by 2° quadrangle, southeast Idaho. Washington, DC: U.S. Department of the Interior, Geologic Survey; 1974.

Richmond, G. M. Surficial geologic map of the Warm River Butte quadrangle, Yellowstone National Park and adjoining area, Idaho and Wyoming. Misc. Geol. Investigations; MAP I-645. Washington, DC: U.S. Department of the Interior, Geologic Survey; 1973.

Romesburg, H. C.; Marshall, K. User's manual for CLUSTAR/CLUSTID computer programs for hierarchical cluster analysis. Belmont, CA: Lifetime Learning Publications; 1984. 89 p.

Schlatterer, E. F. A preliminary description of plant communities found on the Sawtooth, White Cloud, Boulder, and Pioneer Mountains. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Region; 1972. 111 p. Unpublished.

Seyer, S. C. Vegetation ecology of a montane mire, Crater Lake National Park, Oregon. Corvallis, OR: Oregon State University; 1979. 187 p. Unpublished.

Smith, E. L. Jr. Soil-vegetation relationships of some *Artemisia* types in North Park, Colorado. Fort Collins, CO: Colorado State University; 1966. Unpublished.

Staatz, M. H.; Albee, H. F. Preliminary geologic map of the Garns Mountain S.E. quadrangle, Bonneville and Teton Counties, Idaho. Mineral investigations field studies map, MF-262. Washington, DC: U.S. Department of the Interior, Geologic Survey; 1963.

Steele, R.; Pfister, R. D.; Ryker, R. A.; Kittams, J. A. Forest habitat types of central Idaho. Gen. Tech. Rep. INT-114. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1981. 138 p.

Steele, R.; Cooper, S. V.; Ondov, D. M.; Roberts, D. W.; Pfister, R. D. Forest habitat types of eastern Idaho-western Wyoming. Gen. Tech. Rep. INT-144. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1983. 122 p.

Stevens, L.; Brown, B. T.; Simpson, J. M.; Johnson, R. R. The importance of riparian habitat to migrating birds. In: Importance, preservation and management of riparian habitat: a symposium. Gen. Tech. Rep. RM-43. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station; 1977: 156-164.

Swanson, F. J.; Gregory, S. V.; Sedell, J. R.; Campbell, A. G. Land-water interactions: the riparian zone. In: Edmonds, R. L., ed. Analysis of coniferous forest ecosystems in the western United States. US/IBP Synthesis Series 14. Stroudsberg, PA: Hutchinson Ross Publishing Co.; 1982: 267-291.

Terwilliger, C., Jr.; Hess, K.; Wasser, C. H. The plant associations of Region II, USDA Forest Service. Progress report, cooperation agreement 16-845-CA to U.S. Department of Agriculture, Forest Service, Rocky Mountain Region. 1979. Unpublished.

Thomas, J. W.; Maser, C.; Rodiek, J. E. Riparian zones. In: Wildlife habitats in managed forests, the Blue Mountains of Oregon and Washington. Ag. Handb. 553. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station; 1979a: 40-47.

Thomas, J. W.; Maser, C.; Rodiek, J. E. Wildlife habitats in managed rangelands--the Great Basin of southeastern Oregon: Riparian zones. Gen. Tech. Rep. PNW-80. Portland, OR: U.S. Department of Agriculture, Pacific Northwest Forest and Range Experiment Station; 1979b. 18 p.

Thornbury, W. Regional geomorphology of the United States. New York: John Wiley and Sons; 1965. 609 p.

Torrey, J. G.; Clarkson, D. T.; eds. The development and function of roots. New York: Academic Press; 1975. 618 p.

Tuhy, J. S.; Jensen, S. Riparian classification for the Upper Salmon/Middle Fork Salmon Rivers, Idaho. Smithfield, UT: White Horse Associates; 1982. 200 p. Unpublished.

Tweit, S. J.; Houston, K. E. Grassland and shrubland habitat types of the Shoshone National Forest. Cody, WY: U.S. Department of Agriculture, Shoshone National Forest; 1980. 143 p. Unpublished.

U.S. Department of Agriculture, Soil Conservation Service. National soils handbook. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service; 1983. 619 p. 1983. 619 p.

U.S. Department of Agriculture, Soil Conservation Service. Soil taxonomy--a basic system of soil classification for making and interpreting soil surveys. Ag. Handb. No. 436. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service; 1975. 754 p.

Vine, J. D. Geology and uranium deposits in carbonaceous rocks of the Fall Creek area, Bonneville County, Idaho. Bull. 1055-1. Washington, DC: U.S. Department of the Interior, Geologic Survey; 1959.

Youngblood, A. P. Vegetation analysis for the Cache Creek EIS, Bridger-Teton National Forest. Open-File Report 81-863. Denver, CO: U.S. Department of the Interior, Geological Survey; 1980. 32 p.

Youngblood, A. P.; Mueggler, W. F. Aspen community types on the Bridger-Teton National Forest in western Wyoming. Res. Pap. INT-272. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 1981. 34 p.

APPENDIX A. NUMBER OF SAMPLE STANDS BY RIPARIAN COMMUNITY TYPE AND VICINITY IN EASTERN IDAHO AND WESTERN WYOMING.

CM = Centennial Mountains; Targhee National Forest
TG = Teton and Snake River Range, Big Hole Mountains, and Yellowstone Volcanic Plateau; Targhee National Forest
CR = Caribou and Webster Ranges; Caribou National Forest
GR = Greys River drainage; Bridger-Teton National Forest
WR = Wyoming Range (east side); Bridger-Teton National Forest

	Vicinity					
Community Type	**CM**	**TG**	**CR**	**GR**	**WR**	**TOTAL**
Tree-Dominated Community Types						
PICEA/EQAR	.	1	1	4	.	6
PICEA/COST	1	1	1	4	.	7
PICEA/CACA	.	.	.	1	.	1
PICEA/GATR	3	4	.	5	.	12
POAN/COST	.	3	1	.	.	4
POAN/POPR	.	3	.	1	.	4
						34
Mixed Shrub-Dominated Community Types						
ALIN/RIHU	.	2	5	2	.	9
COST/HELA	2	1	3	.	.	6
COST/GATR	2	6	.	4	.	12
RHAL	.	4	5	.	.	9
POFR/DECE	.	.	1	.	6	7
POFR/FEID	.	.	1	.	5	6
POFR/POPR	1	.	.	.	1	2
ARCA/FEID	.	.	1	1	5	7
ARCA/POPR	1	.	.	.	2	3
						61
Salix geyeriana-Dominated Community Types						
SAGE/POPA	5	2	.	.	.	7
SAGE/CARO	4	2	1	.	.	7
SAGE/CACA	3	.	.	.	.	3
SAGE/MF	3	1	.	1	.	5
SAGE/POPR	1	2	3	.	.	6
						28
Salix boothii-Dominated Community Types						
SABO/CARO	6	5	5	10	.	26
SABO/CANE	2	.	.	.	.	2
SABO/CACA	2	1	2	1	.	6
SABO/EQAR	5	1	.	9	.	15
SABO/POPA	.	2	.	.	.	2
SABO/SMST	7	4	4	23	.	38
SABO/POPR	3	3	4	9	1	20
						109

(cont.)

APPENDIX A (cont.)

Community Type	Vicinity					
	CM	TG	CR	GR	WR	TOTAL
Salix wolfii-Dominated Community Types						
SAWO/CAAQ	1	2	2	12	1	18
SAWO/CARO	3	1	.	11	.	15
SAWO/CACA	2	.	.	.	.	2
SAWO/CANE	1	.	.	1	2	4
SAWO/DECE	.	.	.	3	1	4
SAWO/POPA	2	.	.	1	.	3
SAWO/MF	3	.	.	20	3	26
						72
Other *Salix*-Dominated Community Types						
SAEX/EQAR	.	4	1	4	.	9
SAEX/POPR	.	2	2	8	.	12
SALU	3	.	1	.	.	4
SAPL	3	1	.	.	.	4
SAEA	.	2	.	.	.	2
						31
Graminoid-Dominated Community Types						
CAMI	1	2	2	8	1	14
CASI	.	2	.	1	6	9
CARO	6	4	3	14	2	29
CAAQ	3	.	1	2	1	7
CANE	4	3	2	.	1	10
CAREX	2	3	1	.	2	8
JUBA	2	.	1	.	5	8
DECE	1	3	1	6	.	11
POPA	1	1	1	.	.	3
POPR	1	.	1	2	.	4
						103
Forb-Dominated Community Types						
VECA	.	1	1	.	.	2
MECI	1	.	.	5	.	6
MFM	3	.	.	2	.	4
						12
Wetland Communities	2	5	1	1	.	9
						9
Unclassified stands	2	4	.	3	1	10
						10
TOTAL	98	88	59	178	46	469

APPENDIX B. CONSTANCY AND AVERAGE COVER (IN PARENTHESES) OF IMPORTANT PLANTS IN EASTERN IDAHO AND WESTERN WYOMING RIPARIAN COMMUNITY TYPES.

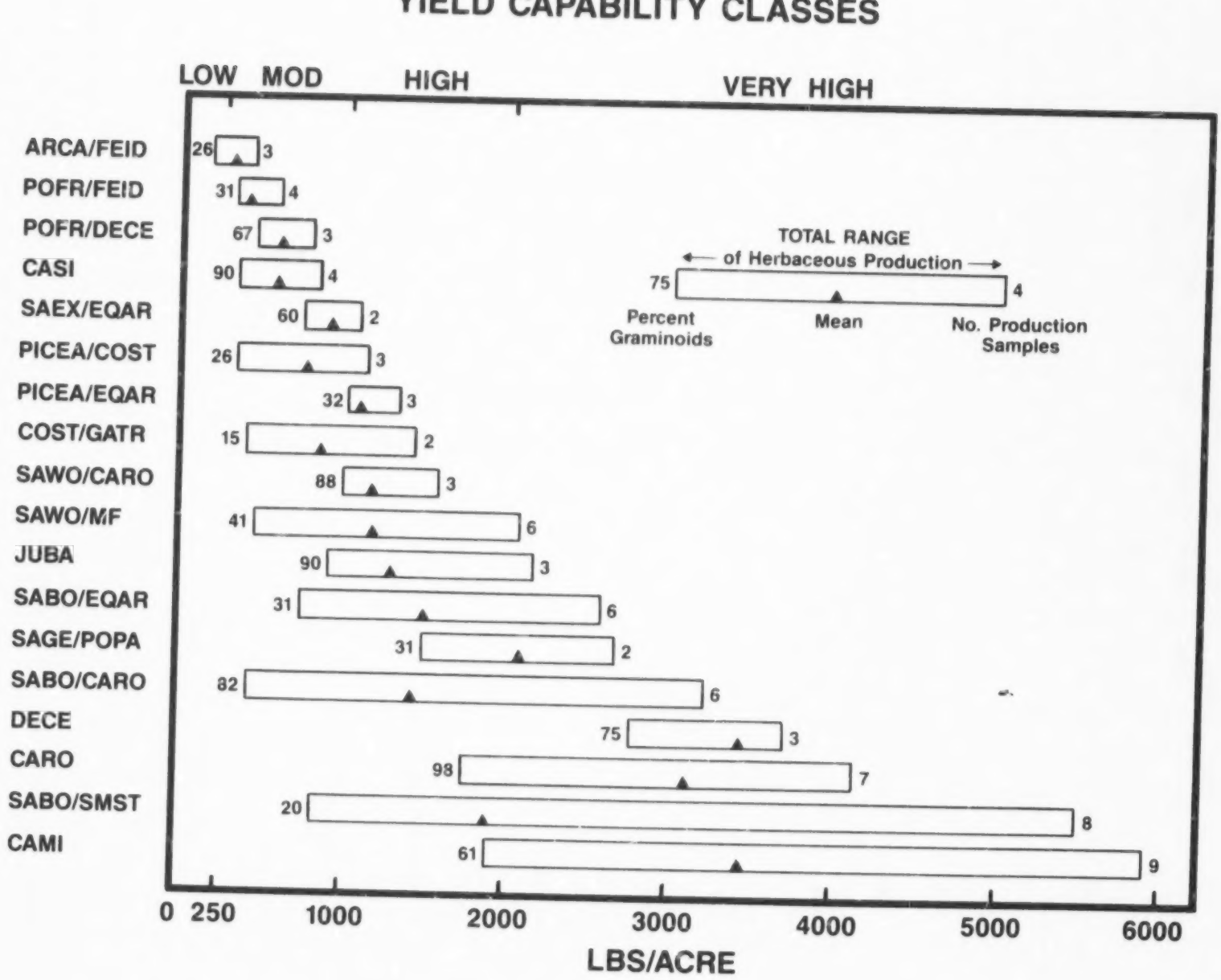
	PICEA /EGAR	PICEA /COST	PICEA /GATR	ALIN/ RIHU	COST/ HELA	COST/ GATR	RHAL	POFR/ DECE	POFR/ FEID	ARCA/ FEID	SAGE/ CARO
NUMBER OF PLOTS PER GROUP:	6	7	12	9	6	12	9	7	6	7	7
TREES											
ABIES LASIOCARPA	33(8)	57(10)	67(15)	11(1)	-(-)	25(8)	11(3)	-(-)	-(-)	-(-)	14(1)
PICEA ENGELMANNII	100(58)	86(33)	75(40)	11(3)	-(-)	17(1)	11(5)	-(-)	-(-)	-(-)	-(-)
PINUS CONTORTA	50(4)	-(-)	33(30)	-(-)	-(-)	-(-)	11(40)	-(-)	-(-)	-(-)	-(-)
POPULUS TREMULOIDES	-(-)	-(-)	8(1)	11(3)	-(-)	-(-)	22(4)	-(-)	-(-)	-(-)	14(1)
POPULUS ANGUSTIFOLIA	-(-)	-(-)	8(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SHRUBS											
ALNUS INCANA	-(-)	57(23)	17(23)	78(54)	33(6)	33(15)	-(-)	-(-)	-(-)	-(-)	14(1)
AMELANCHIER ALNIFOLIA	50(2)	29(1)	67(2)	11(15)	-(-)	17(1)	11(1)	-(-)	-(-)	-(-)	-(-)
ARTEMISIA CANA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	71(11)	100(21)	100(43)	-(-)
ARTEMISIA TRIDENTATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	50(2)	14(1)	-(-)
BETULA GLANDULOSA	-(-)	14(1)	17(3)	11(2)	-(-)	8(63)	-(-)	-(-)	-(-)	-(-)	14(1)
BETULA OCCIDENTALIS	-(-)	-(-)	-(-)	11(38)	17(50)	17(35)	-(-)	-(-)	-(-)	-(-)	14(8)
CORNUS STOLONIFERA	17(1)	100(53)	33(8)	67(46)	100(67)	100(72)	22(3)	-(-)	-(-)	-(-)	14(2)
CRATAEGUS DOUGLASII	-(-)	-(-)	-(-)	11(7)	33(30)	8(15)	11(1)	-(-)	-(-)	-(-)	-(-)
LONICERA INVOLUCRATA	83(2)	57(4)	75(10)	22(4)	33(12)	33(7)	56(4)	-(-)	-(-)	-(-)	43(4)
POTENTILLA FRUTICOSA	-(-)	14(1)	17(9)	-(-)	-(-)	-(-)	-(-)	100(27)	100(17)	14(1)	29(1)
RHAMNUS ALNIFOLIA	-(-)	-(-)	8(4)	-(-)	-(-)	-(-)	100(87)	-(-)	-(-)	-(-)	-(-)
RIBES HUDSONIANUM	17(1)	29(6)	8(1)	67(41)	17(5)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
RIBES INERME	33(2)	57(5)	42(4)	22(3)	-(-)	33(1)	-(-)	-(-)	-(-)	-(-)	14(39)
RIBES LACUSTRE	-(-)	43(17)	33(23)	44(2)	50(6)	42(9)	67(6)	-(-)	-(-)	-(-)	29(3)
RIBES SETOSUM	-(-)	-(-)	-(-)	-(-)	17(1)	17(8)	-(-)	-(-)	-(-)	-(-)	-(-)
ROSA WOODSII	67(1)	71(6)	33(16)	44(7)	50(9)	58(4)	22(4)	-(-)	-(-)	-(-)	29(1)
SALIX BOOTHII	33(2)	43(34)	33(17)	22(3)	67(40)	42(7)	33(17)	-(-)	-(-)	14(2)	43(13)
SALIX DRUMMONDIANA	-(-)	43(18)	17(22)	22(5)	17(13)	25(15)	44(14)	-(-)	-(-)	-(-)	14(3)
SALIX EXIGUA	-(-)	43(2)	33(2)	33(3)	33(14)	33(7)	11(20)	-(-)	-(-)	-(-)	-(-)
SALIX GEYERIANA	-(-)	-(-)	-(-)	-(-)	17(20)	-(-)	11(35)	-(-)	-(-)	-(-)	100(60)
SALIX LASIANDRA	-(-)	-(-)	8(8)	11(5)	17(40)	8(20)	-(-)	-(-)	-(-)	-(-)	-(-)
SALIX LUTEA	17(50)	-(-)	8(3)	11(2)	33(4)	42(7)	11(7)	-(-)	-(-)	-(-)	-(-)
SALIX WOLFII	17(1)	-(-)	8(3)	-(-)	-(-)	8(1)	-(-)	43(6)	50(1)	14(2)	-(-)
SYMPHORICARPOS ALBUS	33(2)	43(2)	42(4)	22(3)	17(25)	17(1)	11(3)	-(-)	-(-)	-(-)	-(-)
GRAMINOIDS											
AGROSTIS STOLONIFERA	-(-)	-(-)	8(1)	11(40)	-(-)	25(14)	-(-)	-(-)	-(-)	-(-)	-(-)
CALAMAGROSTIS CANADENSIS	50(11)	29(27)	33(1)	33(4)	33(13)	17(2)	44(12)	-(-)	-(-)	-(-)	14(15)
CAREX AQUATILIS	83(6)	-(-)	8(5)	11(10)	-(-)	8(1)	-(-)	-(-)	-(-)	-(-)	29(28)
CAREX ATHROSTACHYA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CAREX HOODII	-(-)	-(-)	8(1)	-(-)	-(-)	8(1)	-(-)	-(-)	-(-)	14(2)	-(-)
CAREX LANGUINOSA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	11(6)	14(5)	17(1)	14(1)	14(1)
CAREX MICROPTERA	33(1)	29(1)	8(1)	11(10)	-(-)	33(1)	11(1)	86(8)	33(5)	57(7)	43(11)
CAREX NEBRASCENSIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	14(3)
CAREX PRAEGRACILIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	57(30)	17(1)	14(1)	-(-)
CAREX ROSTRATA	67(1)	14(1)	17(2)	11(1)	-(-)	-(-)	33(5)	-(-)	-(-)	-(-)	100(44)
CAREX STELLATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
DESCHAMPSIA CESPITOSA	17(3)	-(-)	8(3)	-(-)	-(-)	-(-)	11(5)	100(29)	33(1)	-(-)	43(1)
ELYMUS GLAUCUS	83(7)	29(3)	67(1)	67(2)	50(1)	67(3)	44(11)	-(-)	-(-)	-(-)	-(-)
FESTUCA IDAHOENSIS	-(-)	-(-)	8(1)	-(-)	-(-)	-(-)	-(-)	14(15)	100(23)	100(22)	-(-)
GLYCERIA STRIATA	50(1)	14(1)	-(-)	67(1)	17(1)	8(8)	33(6)	-(-)	-(-)	-(-)	43(16)
JUNCUS BALTICUS	33(2)	-(-)	17(5)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	14(1)	-(-)
MELICA SPECTABILIS	-(-)	-(-)	-(-)	11(1)	-(-)	-(-)	-(-)	-(-)	17(3)	29(5)	-(-)
PHLEUM ALPINUM	33(1)	-(-)	17(1)	-(-)	-(-)	8(1)	-(-)	29(2)	33(2)	29(1)	-(-)
PHLEUM PRATENSE	17(1)	29(2)	17(2)	11(1)	17(1)	8(1)	11(1)	-(-)	17(1)	14(1)	14(1)
POA PALUSTRIS	17(1)	-(-)	17(3)	22(7)	17(3)	8(1)	22(45)	-(-)	-(-)	-(-)	43(3)
POA PRATENSIS	50(1)	43(2)	33(2)	44(3)	33(4)	42(24)	22(2)	86(5)	33(1)	71(1)	43(1)
FORBS											
ACONITUM COLUMBIANUM	-(-)	-(-)	17(15)	11(7)	17(2)	-(-)	22(3)	-(-)	-(-)	-(-)	-(-)
ACTAEA RUBRA	-(-)	86(7)	58(16)	22(9)	50(1)	50(4)	11(1)	-(-)	-(-)	-(-)	-(-)
ANGELICA ARGUTA	17(15)	43(2)	33(2)	22(2)	-(-)	50(4)	-(-)	-(-)	-(-)	-(-)	-(-)
ASTER	33(4)	29(1)	8(8)	22(2)	50(1)	8(3)	11(4)	29(5)	-(-)	-(-)	14(2)
ASTER EATONII	17(3)	-(-)	-(-)	-(-)	-(-)	8(3)	-(-)	14(5)	17(1)	14(3)	14(13)
ASTER INTEGRIFOLIUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	29(20)	14(1)
ASTER FOLIACEUS	50(6)	71(4)	67(9)	11(1)	17(3)	33(2)	11(15)	57(12)	50(15)	43(4)	29(7)
ASTER MODESTUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ASTER OCCIDENTALIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CALTHA LEPTOSEPALA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CICUTA DOUGLASII	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	11(1)	-(-)	-(-)	-(-)	-(-)
FRAGARIA VIRGINIANA	100(1)	57(1)	83(4)	-(-)	-(-)	33(13)	33(1)	100(18)	100(20)	86(7)	14(1)
GALIUM BOREALE	50(1)	43(1)	75(2)	-(-)	33(1)	17(2)	22(1)	-(-)	50(1)	-(-)	-(-)
GALIUM TRIFLORUM	50(1)	100(5)	50(6)	33(2)	83(2)	83(2)	67(3)	-(-)	-(-)	-(-)	29(1)
GERANIUM RICHARDSONII	100(5)	71(2)	75(4)	67(2)	17(1)	42(2)	33(1)	-(-)	-(-)	-(-)	29(1)
GERANIUM VISCOSISSIMUM	-(-)	29(1)	17(3)	-(-)	-(-)	-(-)	-(-)	-(-)	17(5)	-(-)	-(-)
GEUM MACROPHYLLUM	33(2)	29(1)	42(1)	67(1)	67(2)	25(1)	67(1)	-(-)	17(3)	14(1)	86(3)
HELENIUM HOOPESII	17(1)	-(-)	25(1)	-(-)	17(1)	25(2)	-(-)	71(16)	100(12)	71(26)	-(-)
HERACLEUM LANATUM	-(-)	71(2)	50(2)	67(10)	100(17)	58(2)	44(7)	-(-)	-(-)	-(-)	-(-)
MERTENSIA CILIATA	-(-)	-(-)	8(1)	11(2)	50(1)	17(1)	-(-)	-(-)	-(-)	-(-)	-(-)
MITELLA PENTANDRA	17(1)	14(1)	17(4)	-(-)	-(-)	8(1)	11(10)	-(-)	-(-)	-(-)	-(-)
OSMORHIZA CHILENSIS	50(1)	29(2)	50(4)	11(1)	17(1)	42(2)	-(-)	-(-)	-(-)	-(-)	-(-)
OSMORHIZA DEPAUPERATA	-(-)	29(1)	17(1)	22(1)	-(-)	8(50)	11(1)	-(-)	-(-)	-(-)	14(1)
OSMORHIZA OCCIDENTALIS	-(-)	-(-)	17(8)	-(-)	-(-)	8(1)	-(-)	-(-)	-(-)	-(-)	-(-)
PEDICULARIS GROENLANDICA	-(-)	-(-)	8(1)	-(-)	-(-)	-(-)	-(-)	14(2)	17(1)	-(-)	-(-)
POLEMONIUM OCCIDENTALE	50(1)	14(1)	8(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
POLYGONUM BISTORTOIDES	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
POTENTILLA GRACILIS	17(1)	14(1)	33(1)	-(-)	-(-)	8(1)	-(-)	86(15)	83(5)	57(8)	-(-)
RANUNCULUS ALISMAEFOLIUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	14(1)	-(-)	-(-)	-(-)
SAXIFRAGA ODONTOLOMA	50(14)	43(1)	-(-)	11(5)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SENECIO SERRA	33(1)	14(1)	25(1)	22(2)	33(12)	17(1)	44(3)	-(-)	-(-)	-(-)	-(-)
SENECIO TRIANGULARIS	67(3)	29(2)	25(15)	22(2)	-(-)	17(2)	22(2)	-(-)	-(-)	-(-)	-(-)
SMILACINA STELLATA	67(2)	71(4)	75(6)	44(13)	67(2)	75(4)	44(1)	14(1)	-(-)	-(-)	14(1)
SOLIDAGO CANADENSIS	33(8)	-(-)	42(1)	11(15)	33(1)	25(1)	-(-)	-(-)	-(-)	-(-)	14(1)
SWERTIA PERENNIS	17(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
THALICTRUM FENDLERI	67(1)	57(2)	42(5)	11(3)	17(2)	25(2)	22(5)	14(1)	17(1)	14(1)	-(-)
THALICTRUM OCCIDENTALE	-(-)	29(1)	50(15)	11(15)	33(2)	33(4)	-(-)	-(-)	-(-)	-(-)	-(-)
VALERIANA OCCIDENTALIS	-(-)	14(3)	25(1)	-(-)	-(-)	8(1)	22(1)	57(4)	17(30)	57(4)	-(-)
VERATRUM CALIFORNICUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ZIZIA APTERA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
EQUISETUM ARVENSE	100(73)	71(8)	58(3)	33(7)	-(-)	58(3)	33(15)	-(-)	-(-)	14(1)	14(85)
EQUISETUM HYEMALE	50(1)	29(3)	33(1)	11(1)	17(1)	17(18)	11(40)	-(-)	17(1)	-(-)	-(-)

APPENDIX B (cont.)

	SAGE/ POVA	SAGE/ MESIC FORB	SAGE/ POPR	SABO/ CARO	SABO/ CACA	SABO/ EQAR	SABO/ SMST	SABO/ POPR	SAWO/ CAAQ	SAWO/ CARO	SAWO/ MESIC FORB
NUMBER OF PLOTS PER GROUP:	7	5	6	26	6	15	38	20	18	15	26
TREES											
ABIES LASIOCARPA	-(-)	-(-)	-(-)	4(1)	17(15)	27(1)	5(2)	15(3)	-(-)	-(-)	4(1)
PICEA ENGELMANNII	-(-)	-(-)	-(-)	15(3)	17(1)	27(2)	5(2)	5(13)	11(2)	7(1)	15(4)
PINUS CONTORTA	14(3)	-(-)	-(-)	-(-)	-(-)	7(3)	3(1)	20(5)	-(-)	7(38)	4(1)
POPULUS TREMULOIDES	14(3)	20(1)	17(15)	-(-)	-(-)	-(-)	-(-)	5(1)	-(-)	-(-)	-(-)
POPULUS ANGUSTIFOLIA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	5(15)	-(-)	-(-)	-(-)
SHRUBS											
ALNUS INCANA	-(-)	-(-)	-(-)	4(2)	-(-)	-(-)	5(12)	5(3)	-(-)	-(-)	-(-)
AMELANCHIER ALNIFOLIA	-(-)	-(-)	17(1)	-(-)	-(-)	-(-)	5(1)	25(5)	-(-)	-(-)	-(-)
ARTEMISIA CANA	-(-)	20(3)	50(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	15(15)
ARTEMISIA TRIDENTATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	5(1)	-(-)	-(-)	-(-)
BETULA GLANDULOSA	-(-)	-(-)	-(-)	15(8)	33(25)	13(2)	11(12)	20(17)	28(9)	27(30)	19(40)
BETULA OCCIDENTALIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CORNUS STOLONIFERA	-(-)	-(-)	-(-)	4(3)	17(10)	13(15)	5(6)	30(18)	-(-)	-(-)	-(-)
CRATAEGUS DOUGLASII	-(-)	-(-)	17(4)	-(-)	-(-)	-(-)	-(-)	10(13)	-(-)	-(-)	-(-)
LONICERA INVOLUCRATA	14(3)	20(8)	83(10)	54(2)	67(14)	53(4)	45(10)	50(3)	6(1)	20(1)	23(4)
POTENTILLA FRUTICOSA	-(-)	20(15)	17(8)	-(-)	-(-)	7(3)	11(8)	30(2)	39(3)	27(8)	27(15)
RHAMNUS ALNIFOLIA	-(-)	-(-)	-(-)	4(1)	-(-)	7(15)	-(-)	10(25)	-(-)	-(-)	-(-)
RIBES HUDSONIANUM	-(-)	-(-)	-(-)	-(-)	-(-)	13(1)	5(43)	5(2)	-(-)	-(-)	-(-)
RIBES INERME	14(3)	40(6)	-(-)	31(5)	-(-)	53(14)	47(13)	10(3)	-(-)	-(-)	27(7)
RIBES LACUSTRE	-(-)	60(22)	83(9)	31(3)	83(8)	13(2)	26(10)	45(12)	-(-)	-(-)	4(13)
RIBES SETOSUM	-(-)	-(-)	-(-)	4(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ROSA WOODSII	14(3)	-(-)	33(6)	8(1)	-(-)	13(1)	8(1)	50(3)	-(-)	-(-)	4(1)
SALIX BOOTHII	43(18)	40(30)	33(7)	88(57)	83(72)	87(46)	87(63)	100(42)	11(1)	13(13)	23(15)
SALIX DRUMMONDIANA	14(8)	20(20)	17(10)	62(31)	67(30)	80(39)	63(47)	65(25)	-(-)	-(-)	4(1)
SALIX EXIGUA	-(-)	-(-)	-(-)	4(1)	-(-)	7(1)	3(1)	30(11)	-(-)	-(-)	4(1)
SALIX GEYERIANA	100(62)	100(60)	100(68)	-(-)	17(13)	-(-)	5(22)	10(8)	-(-)	-(-)	-(-)
SALIX LASIANDRA	14(3)	-(-)	-(-)	-(-)	-(-)	7(3)	5(6)	5(3)	-(-)	-(-)	-(-)
SALIX LUTEA	14(7)	-(-)	-(-)	8(12)	-(-)	13(4)	3(8)	10(11)	-(-)	-(-)	-(-)
SALIX WOLFII	-(-)	-(-)	-(-)	-(-)	17(38)	20(6)	16(6)	15(3)	100(53)	100(62)	96(62)
SYMPHORICARPOS ALBUS	-(-)	-(-)	17(5)	-(-)	-(-)	-(-)	3(5)	25(3)	-(-)	-(-)	-(-)
GRAMINOIDS											
AGROSTIS STOLONIFERA	14(20)	-(-)	-(-)	8(1)	-(-)	-(-)	5(1)	20(6)	-(-)	7(3)	12(1)
CALAMAGROSTIS CANADENSIS	14(1)	20(3)	-(-)	46(14)	100(44)	40(5)	39(2)	15(3)	-(-)	13(1)	4(1)
CAREX AQUATILIS	57(6)	-(-)	-(-)	62(19)	17(3)	47(4)	18(1)	15(1)	100(47)	80(15)	38(1)
CAREX ATHROSTACHYA	43(1)	20(1)	-(-)	8(1)	-(-)	7(1)	8(1)	-(-)	-(-)	-(-)	-(-)
CAREX HOODII	14(1)	-(-)	-(-)	-(-)	17(1)	-(-)	13(1)	5(1)	-(-)	-(-)	4(1)
CAREX LANUGINOSA	-(-)	-(-)	50(19)	4(3)	17(1)	13(14)	5(1)	5(15)	6(65)	-(-)	12(28)
CAREX MICROPTERA	57(3)	-(-)	17(1)	19(1)	17(3)	53(1)	32(3)	30(21)	17(4)	20(11)	50(1)
CAREX NEBRASCENSIS	14(1)	-(-)	-(-)	4(1)	-(-)	-(-)	-(-)	-(-)	8(1)	7(1)	-(-)
CAREX PRAEGRACILIS	-(-)	-(-)	17(2)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	12(1)
CAREX ROSTRATA	43(6)	-(-)	17(2)	100(55)	67(9)	53(9)	26(4)	15(2)	78(29)	100(56)	35(1)
CAREX SIMULATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	11(12)	-(-)	-(-)
DESCHAMPSIA CESPITOSA	14(13)	20(1)	50(24)	23(3)	-(-)	20(1)	24(3)	15(3)	50(3)	40(3)	50(2)
ELYMUS GLAUCUS	14(20)	40(8)	33(2)	4(1)	33(3)	13(2)	3(21)	45(5)	-(-)	-(-)	15(1)
FESTUCA IDAHOENSIS	-(-)	-(-)	17(6)	-(-)	-(-)	-(-)	-(-)	10(2)	-(-)	-(-)	12(14)
GLYCERIA STRIATA	43(8)	-(-)	-(-)	12(5)	-(-)	20(1)	11(9)	20(4)	-(-)	7(3)	4(1)
JUNCUS BALTICUS	43(5)	-(-)	67(7)	15(12)	-(-)	20(5)	8(1)	20(4)	33(5)	20(1)	27(4)
MELICA SPECTABILIS	-(-)	40(1)	33(2)	-(-)	-(-)	7(1)	13(1)	-(-)	-(-)	-(-)	19(1)
PHLEUM ALPINUM	29(2)	20(3)	17(1)	4(1)	-(-)	13(1)	8(1)	15(1)	11(1)	-(-)	23(1)
PHLEUM PRATENSE	43(1)	40(27)	50(1)	4(1)	17(1)	20(3)	8(1)	30(1)	6(1)	-(-)	23(1)
POA PALUSTRIS	100(46)	40(7)	-(-)	27(5)	17(3)	53(4)	47(3)	35(3)	-(-)	-(-)	19(2)
POA PRATENSIS	86(6)	40(8)	100(23)	38(1)	33(1)	60(1)	55(7)	85(19)	39(2)	7(1)	65(6)
FORBS											
ACONITUM COLUMBIANUM	29(17)	20(20)	-(-)	-(-)	-(-)	-(-)	5(11)	5(10)	-(-)	7(1)	-(-)
ACTAEA RUBRA	-(-)	20(5)	-(-)	4(3)	-(-)	20(1)	11(2)	15(1)	-(-)	-(-)	-(-)
ANGELICA ARGUTA	-(-)	20(39)	-(-)	4(1)	17(15)	13(2)	5(12)	20(8)	-(-)	-(-)	12(5)
ASTER	14(10)	20(1)	17(1)	19(5)	33(3)	7(2)	3(1)	5(10)	11(1)	-(-)	8(1)
ASTER EATONII	14(8)	-(-)	-(-)	12(5)	-(-)	-(-)	-(-)	5(1)	-(-)	-(-)	4(1)
ASTER FOLIACEUS	29(1)	60(2)	33(33)	38(1)	33(9)	47(2)	53(12)	60(15)	56(7)	87(6)	77(12)
ASTER MODESTUS	-(-)	-(-)	-(-)	12(1)	-(-)	7(8)	5(8)	-(-)	-(-)	7(1)	-(-)
ASTER OCCIDENTALIS	-(-)	-(-)	-(-)	8(8)	-(-)	20(5)	3(1)	10(1)	-(-)	-(-)	-(-)
CALTHA LEPTOSEPALA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	6(38)	-(-)	-(-)
CICUTA DOUGLASII	-(-)	-(-)	-(-)	-(-)	-(-)	7(13)	-(-)	5(1)	-(-)	-(-)	-(-)
FRAGARIA VIRGINIANA	57(3)	100(6)	83(12)	31(1)	33(8)	73(1)	61(9)	80(6)	72(4)	80(2)	100(17)
GALIUM BOREALE	29(1)	80(2)	50(15)	15(1)	33(7)	7(3)	29(3)	45(6)	11(4)	27(1)	46(3)
GALIUM TRIFLORUM	14(1)	20(1)	-(-)	19(2)	33(2)	60(2)	29(4)	20(3)	-(-)	7(1)	4(1)
GERANIUM RICHARDSONII	43(2)	40(2)	-(-)	23(2)	-(-)	93(5)	37(2)	45(3)	6(3)	-(-)	19(2)
GERANIUM VISCOSISSIMUM	-(-)	20(15)	17(13)	-(-)	-(-)	-(-)	3(1)	15(2)	-(-)	-(-)	8(2)
GEUM MACROPHYLLUM	86(1)	20(3)	67(2)	46(2)	50(4)	87(1)	71(1)	50(8)	17(1)	27(1)	58(2)
HELENIUM HOOPESII	-(-)	-(-)	50(9)	12(1)	33(12)	20(1)	39(3)	30(1)	22(1)	7(1)	69(11)
HERACLEUM LANATUM	-(-)	60(16)	-(-)	4(1)	33(3)	20(5)	47(7)	55(3)	-(-)	-(-)	8(2)
MERTENSIA CILIATA	14(1)	20(1)	-(-)	-(-)	17(8)	27(8)	42(10)	10(4)	-(-)	-(-)	8(2)
MITELLA PENTANDRA	-(-)	-(-)	-(-)	8(1)	-(-)	40(3)	5(25)	-(-)	6(1)	-(-)	-(-)
OSMORHIZA CHILENSIS	14(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	15(5)	-(-)	-(-)	-(-)
OSMORHIZA DEPAUPERATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	5(1)	-(-)	-(-)	-(-)
OSMORHIZA OCCIDENTALIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	3(1)	10(2)	-(-)	-(-)	-(-)
PEDICULARIS GROENLANDICA	14(3)	-(-)	-(-)	4(1)	-(-)	-(-)	3(1)	-(-)	-(-)	-(-)	-(-)
POLEMONIUM OCCIDENTALE	-(-)	-(-)	17(1)	31(6)	17(1)	53(2)	26(5)	10(1)	83(5)	80(10)	54(6)
POLYGONUM BISTORTOIDES	-(-)	20(1)	-(-)	-(-)	-(-)	-(-)	3(2)	-(-)	6(1)	7(1)	4(1)
POTENTILLA GRACILIS	71(4)	60(22)	83(19)	-(-)	-(-)	-(-)	24(2)	35(2)	6(1)	7(1)	38(1)
RANUNCULUS ALISMAEFOLIUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SAXIFRAGA ODONTOLOMA	-(-)	20(1)	-(-)	15(2)	-(-)	67(17)	11(1)	5(1)	11(2)	7(1)	4(1)
SENECIO SERRA	-(-)	60(1)	-(-)	-(-)	17(1)	7(3)	13(4)	5(1)	-(-)	-(-)	-(-)
SENECIO TRIANGULARIS	-(-)	20(2)	-(-)	15(2)	-(-)	40(6)	18(6)	15(1)	6(1)	-(-)	15(20)
SMILACINA STELLATA	29(1)	40(1)	83(5)	58(2)	50(5)	47(1)	71(16)	75(2)	39(1)	27(5)	38(1)
SOLIDAGO CANADENSIS	43(16)	40(3)	17(15)	23(1)	33(1)	27(14)	24(5)	50(4)	-(-)	7(1)	19(1)
SWERTIA PERENNIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	17(18)	20(3)	-(-)
THALICTRUM FENDLERI	14(1)	-(-)	33(1)	4(1)	17(1)	20(2)	24(32)	40(5)	-(-)	7(1)	19(19)
THALICTRUM OCCIDENTALE	14(1)	60(18)	17(1)	8(1)	33(2)	13(4)	16(7)	20(3)	-(-)	-(-)	8(2)
VALERIANA OCCIDENTALIS	-(-)	40(8)	17(1)	-(-)	-(-)	13(1)	13(1)	15(1)	11(2)	7(1)	35(7)
VERATRUM CALIFORNICUM	-(-)	-(-)	-(-)	-(-)	-(-)	7(20)	3(35)	-(-)	-(-)	-(-)	-(-)
ZIZIA APTERA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	5(1)	28(8)	-(-)	12(10)
EQUISETUM ARVENSE	-(-)	40(5)	17(1)	58(8)	50(6)	100(25)	34(2)	65(4)	22(1)	13(10)	19(1)
EQUISETUM HYEMALE	-(-)	-(-)	17(1)	8(1)	-(-)	13(2)	5(1)	20(5)	11(1)	-(-)	8(1)

APPENDIX B (cont.)

	SAEX/ EGAR	SAEX/ POPR	CANI	CASI	CARO	CAAQ	CANE	JUBA	DECF	MECI
NUMBER OF PLOTS PER GROUP:	8	12	14	11	29	7	10	8	11	6
TREES										
ABIES LASIOCARPA	-(-)	17(2)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	17(3)
PICEA ENGELMANNII	-(-)	17(2)	-(-)	9(1)	3(3)	-(-)	-(-)	-(-)	-(-)	-(-)
PINUS CONTORTA	-(-)	17(9)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
POPULUS TREMULOIDES	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
POPULUS ANGUSTIFOLIA	-(-)	17(11)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SHRUBS										
ALNUS INCANA	25(4)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
AMELANCHIER ALNIFOLIA	-(-)	25(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ARTEMISIA CANA	13(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	25(2)	-(-)	-(-)
ARTEMISIA TRIDENTATA	-(-)	8(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
BETULA GLANDULOSA	13(3)	-(-)	-(-)	9(3)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
BETULA OCCIDENTALIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CORNUS STOLONIFERA	50(8)	25(15)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CRATAEGUS DOUGLASII	13(10)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
LONICERA INVOLUCRATA	50(4)	58(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
POTENTILLA FRUTICOSA	-(-)	33(2)	-(-)	-(-)	3(1)	-(-)	-(-)	13(1)	-(-)	-(-)
RHAMNUS ALNIFOLIA	-(-)	8(25)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
RIBES HUDSONIANUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
RIBES INERME	-(-)	25(1)	7(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
RIBES LACUSTRE	50(9)	17(7)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
RIBES SETOSUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ROSA WOODSII	38(10)	33(3)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SALIX BOOTHII	88(12)	58(10)	21(1)	-(-)	21(5)	29(2)	-(-)	25(1)	18(1)	-(-)
SALIX DRUMMONDIANA	63(6)	25(1)	-(-)	-(-)	7(3)	14(1)	-(-)	-(-)	-(-)	17(1)
SALIX EXIGUA	100(51)	100(49)	-(-)	-(-)	3(1)	-(-)	-(-)	-(-)	-(-)	-(-)
SALIX GEYERIANA	-(-)	-(-)	-(-)	-(-)	10(1)	-(-)	10(3)	-(-)	-(-)	-(-)
SALIX LASIANDRA	13(3)	17(3)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SALIX LUTEA	38(5)	25(1)	-(-)	-(-)	3(3)	-(-)	-(-)	-(-)	-(-)	-(-)
SALIX WOLFII	-(-)	8(3)	21(1)	55(2)	3(1)	14(1)	10(1)	-(-)	18(2)	17(3)
SYMPHORICARPOS ALBUS	25(1)	25(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
GRAMINOIDS										
AGROSTIS STOLONIFERA	13(1)	42(21)	-(-)	-(-)	3(1)	-(-)	10(1)	-(-)	-(-)	-(-)
CALAMAGROSTIS CANADENSIS	75(15)	8(1)	7(20)	-(-)	10(3)	29(2)	20(1)	-(-)	9(1)	-(-)
CAREX AQUATILIS	13(3)	-(-)	57(5)	27(23)	69(16)	100(62)	-(-)	25(12)	55(4)	17(1)
CAREX ATHROSTACHYA	-(-)	-(-)	-(-)	-(-)	3(1)	29(4)	10(1)	-(-)	18(22)	-(-)
CAREX HOODII	13(1)	-(-)	7(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
CAREX LANUGINOSA	-(-)	17(8)	29(5)	9(4)	-(-)	14(3)	20(20)	-(-)	9(55)	-(-)
CAREX MICROPTERA	38(6)	8(1)	100(47)	9(1)	24(6)	43(8)	20(1)	38(1)	73(8)	83(2)
CAREX NEBRASCENSIS	-(-)	-(-)	-(-)	27(16)	3(1)	-(-)	100(59)	-(-)	18(8)	-(-)
CAREX PRAEGRACILIS	-(-)	-(-)	-(-)	18(88)	-(-)	-(-)	10(1)	25(2)	9(1)	-(-)
CAREX ROSTRATA	63(13)	8(1)	64(14)	73(9)	100(77)	71(21)	20(4)	13(15)	73(3)	-(-)
CAREX SIMULATA	-(-)	-(-)	7(1)	82(76)	3(3)	-(-)	30(8)	-(-)	-(-)	-(-)
DESCHAMPSIA CESPITOSA	38(1)	8(1)	71(7)	82(3)	31(4)	29(9)	90(15)	88(2)	100(38)	17(1)
ELYMUS GLAUCUS	38(1)	42(5)	14(1)	-(-)	3(3)	-(-)	-(-)	13(2)	-(-)	17(1)
FESTUCA IDAHOENSIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	13(1)	-(-)	-(-)
GLYCERIA STRIATA	25(5)	17(18)	-(-)	-(-)	21(4)	29(2)	10(1)	-(-)	9(1)	17(8)
JUNCUS BALTICUS	13(1)	8(1)	29(2)	9(15)	7(2)	29(8)	80(15)	100(64)	18(8)	-(-)
MELICA SPECTABILIS	-(-)	-(-)	14(2)	-(-)	-(-)	-(-)	-(-)	-(-)	9(1)	50(2)
PHLEUM ALPINUM	-(-)	25(1)	7(1)	9(1)	7(1)	-(-)	40(2)	63(1)	55(2)	17(1)
PHLEUM PRATENSE	38(2)	42(2)	14(20)	-(-)	-(-)	14(3)	20(3)	13(8)	18(2)	33(1)
POA PALUSTRIS	63(5)	17(1)	14(1)	9(20)	7(1)	29(1)	30(18)	25(3)	9(1)	83(5)
POA PRATENSIS	63(2)	92(20)	79(10)	36(2)	28(5)	57(1)	50(1)	88(1)	64(5)	33(1)
FORBS										
ACONITUM COLUMBIANUM	13(1)	-(-)	7(1)	-(-)	-(-)	-(-)	-(-)	-(-)	9(1)	-(-)
ACTAEA RUBRA	13(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ANGELICA ARGUTA	-(-)	33(2)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ASTER	38(1)	25(7)	-(-)	-(-)	14(6)	14(1)	20(1)	13(1)	9(1)	-(-)
ASTER EATONII	13(1)	-(-)	7(3)	-(-)	-(-)	-(-)	-(-)	25(7)	9(1)	17(3)
ASTER INTEGRIFOLIUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	10(20)	-(-)	9(50)	-(-)
ASTER FOLIACEUS	38(5)	42(7)	50(6)	36(6)	17(11)	43(5)	10(3)	75(4)	36(4)	17(1)
ASTER MODESTUS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ASTER OCCIDENTALIS	13(15)	-(-)	14(3)	-(-)	-(-)	-(-)	40(2)	-(-)	-(-)	-(-)
CALTHA LEPTOSEPALA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	9(50)	-(-)
CICUTA DOUGLASII	-(-)	8(1)	-(-)	9(1)	3(1)	-(-)	10(3)	-(-)	-(-)	-(-)
FRAGARIA VIRGINIANA	25(1)	50(10)	64(5)	9(1)	3(1)	14(1)	10(1)	50(17)	27(6)	50(1)
GALIUM BOREALE	13(1)	8(1)	-(-)	-(-)	3(1)	14(1)	-(-)	-(-)	-(-)	-(-)
GALIUM TRIFLORUM	38(2)	25(3)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
GERANIUM RICHARDSONII	25(1)	33(1)	14(10)	-(-)	3(1)	-(-)	-(-)	-(-)	-(-)	50(13)
GERANIUM VISCOSISSIMUM	-(-)	8(3)	7(3)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
GEUM MACROPHYLLUM	63(6)	33(1)	86(1)	18(1)	52(9)	43(1)	20(1)	25(5)	55(3)	67(1)
HELENIUM HOOPESII	-(-)	17(2)	50(7)	9(1)	7(9)	14(1)	-(-)	13(1)	45(11)	33(15)
HERACLEUM LANATUM	38(7)	17(22)	7(75)	-(-)	-(-)	-(-)	-(-)	-(-)	9(1)	83(51)
MERTENSIA CILIATA	13(1)	8(1)	14(1)	-(-)	3(1)	-(-)	-(-)	-(-)	-(-)	17(1)
MITELLA PENTANDRA	13(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	17(1)
OSMORHIZA CHILENSIS	25(1)	17(2)	-(-)	-(-)	3(1)	-(-)	-(-)	-(-)	-(-)	17(3)
OSMORHIZA DEPAUPERATA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
OSMORHIZA OCCIDENTALIS	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	17(3)
PEDICULARIS GROENLANDICA	-(-)	-(-)	7(1)	45(1)	3(3)	14(1)	10(8)	25(2)	9(6)	-(-)
POLEMONIUM OCCIDENTALE	13(1)	8(3)	57(3)	18(13)	28(10)	29(27)	20(20)	-(-)	27(1)	-(-)
POLYGONUM BISTORTOIDES	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	10(1)	13(1)	36(10)	-(-)
POTENTILLA GRACILIS	-(-)	25(1)	36(3)	9(1)	7(1)	14(1)	40(1)	75(5)	45(15)	50(1)
RANUNCULUS ALISMAEFOLIUS	-(-)	-(-)	7(1)	-(-)	-(-)	-(-)	10(20)	-(-)	9(30)	-(-)
SAXIFRAGA ODONTOLOMA	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	33(32)
SENECIO SERRA	-(-)	8(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
SENECIO TRIANGULARIS	25(1)	-(-)	-(-)	-(-)	-(-)	14(1)	-(-)	-(-)	9(1)	67(36)
SMILACINA STELLATA	38(2)	-(-)	14(1)	-(-)	7(1)	29(2)	-(-)	-(-)	9(1)	-(-)
SOLIDAGO CANADENSIS	38(3)	25(1)	-(-)	-(-)	7(2)	-(-)	-(-)	-(-)	-(-)	-(-)
SWERTIA PERENNIS	-(-)	-(-)	-(-)	18(3)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
THALICTRUM FENDLERI	-(-)	17(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	33(1)
THALICTRUM OCCIDENTALE	13(1)	-(-)	7(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
VALERIANA OCCIDENTALIS	-(-)	-(-)	14(1)	-(-)	3(1)	-(-)	-(-)	-(-)	27(15)	50(1)
VERATRUM CALIFORNICUM	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)
ZIZIA APTERA	-(-)	-(-)	7(3)	9(1)	3(1)	-(-)	-(-)	-(-)	-(-)	-(-)
EQUISETUM ARVENSE	75(26)	33(1)	21(5)	9(25)	17(8)	29(1)	-(-)	-(-)	-(-)	33(1)
EQUISETUM HYEMALE	-(-)	58(1)	-(-)	9(1)	-(-)	-(-)	-(-)	-(-)	-(-)	-(-)



APPENDIX C. HERBACEOUS PRODUCTIVITY OF MAJOR EASTERN IDAHO-WESTERN WYOMING RIPARIAN COMMUNITY TYPES.

APPENDIX D. SUBSTRATE FEATURES OF EASTERN IDAHO AND WESTERN WYOMING RIPARIAN COMMUNITY TYPES.

	PICEA/ COST	PICEA/ GATR	ALIN/ RIHU	COST/ HELA	COST/ GATR	POFR/ DECE	POFR/ FEID
n=	7	12	9	6	12	7	6
SOIL TAXONOMY (% Occurrence)							
Alfisols[1]	.	.	.	.	.	.	.
Entisols							
Cryaquents	.	.	22	.	.	.	.
Fluvaquents	.	.	.	.	.	.	.
Cryofluvents							
Aquic	.	.	.	.	17	.	.
Typic	14	25	11	.	42	.	.
Cryorthents	14	8	.	.	.	.	.
Inceptisols							
Cryaquepts[2]	.	.	.	.	.	.	.
Haplaquepts	.	.	.	.	17	.	.
Histosols							
Terric[3]	.	.	.	.	.	.	.
Typic[4]	.	.	11	.	.	.	.
Mollisols							
Cryaquolls							
Argic	.	.	.	.	.	.	.
Cumulic	14	17	22	34	.	14	.
Histic[5]	.	.	.	.	.	.	.
Typic	14	8	22	33	16	29	17
Cryoborolls							
Aquic	29	17	12	.	.	14	17
Calcic	.	.	.	.	.	.	33
Cumulic[6]	14	8	.	33	8	29	17
Typic	.	17	.	.	.	14	17
FAMILY PARTICLE-SIZE CLASS							
Sandy-skeletal[7]	14	33	11	17	17	.	.
Loamy-skeletal	.	17	.	.	17	57	33
Loamy over -skeletal[8]	28	8	33	33	.	.	.
Clayey over -skeletal[9]	.	.	11	.	.	.	.
Sandy	.	17	.	.	25	.	.
Coarse-loamy[10]	44	8	34	17	41	.	.
Fine-loamy	.	17	.	33	.	43	50
Clayey	14	.	.	.	.	.	17
Other	.	.	11	.	.	.	.
WATER TABLE (cm, mean and 90% C.I.)[11]							
	71±12	76±18	37±24	65±?	84±31	.	.
No. observations	5	7	7	4	5	.	.
AVAILABLE WATER CAPACITY (mean and 90% C.I.)[12]							
	.15±.05	.13±.02	.17±.02	.15±.02	.11±.01	.18±.01	.17±.02
No. observations	6	12	8	6	12	7	6

APPENDIX D (cont.)

	ARCA/ FEID	SAGE/ CARO	SAGE/ POPA	SABO/ CARO	SABO/ EQAR	SABO/ SMST
n=	7	7	7	26	15	38
SOIL TAXONOMY (% Occurrence)						
Alfisols[1]						
Entisols						
Cryaquents						
Fluvaquents				23	40	10
Cryofluvents					7	
Aquic						
Typic				4	13	21
Cryorthents				8		21
Inceptisols						
Cryaquepts[2]						
Haplaquepts				8		8
Histosols						
Terric[3]						
Typic[4]		29		4	7	
Mollisols						
Cryaquolls						
Argic						
Cumulic						
Histic[5]		29	86	19	20	13
Typic		14				
Cyroborolls	14	14	14	23	7	8
Aquic						
Calcic						3
Cumulic[6]						
Typic	43				13	5
	43					
Unknown		14		11		8
FAMILY PARTICLE-SIZE CLASS						
Sandy-skeletal[7]						
Loamy-skeletal	57			4	13	10
Loamy over -skeletal[8]					7	8
Clayey over -skeletal[9]			14	12	7	12
Sandy		14	14			5
Coarse-loamy[10]					7	
Fine-loamy			14	23	13	16
Clayey	29	43	29	23	27	34
Other	14	29	29	23	20	5
		14		15		10
WATER TABLE (cm, mean and 90% C.I.)[11]						
		45±31	37±8	32±10	50±14	70±10
No observations		6	5	22	15	26
AVAILABLE WATER CAPACITY[12]						
	.16±.01	.18±?	.18±.01	.18±.01	.14±.02	.16±.01
No observations	7	4	6	16	11	34

APPENDIX D (cont.)

	SABO/ POPR	SAWO/ CAAQ	SAWO/ CARO	SAWO/ MF	SAEX/ EQAR	SAEX/ POPR	CAMI
n=	20	18	15	26	9	12	14
SOIL TAXONOMY (% Occurrence)							
Alfisols[1]	.	.	7	.	.	.	.
Entisols							
Cryaquents	10	33	40	8	22	8	36
Fluvaquents	.	.	.	.	.	8	.
Cryofluvents							
Aquic	5	.	.	15	22	8	.
Typic	10	.	.	8	12	34	.
Cryorthents	.	.	.	.	.	.	.
Inceptisols							
Cryaquepts[2]	.	6	.	.	.	.	.
Haplaquepts	.	.	.	.	.	.	.
Histosols							
Terric[3]	.	17	33	.	.	.	.
Typic[4]	.	22	.	.	.	.	.
Mollisols							
Cryaquolls							
Argic	.	.	.	.	.	.	.
Cumulic	25	.	.	.	22	8	21
Histic[5]	.	11	7	.	.	.	.
Typic	20	6	7	12	22	.	36
Cryoborolls							
Aquic	20	.	.	23	.	8	.
Calcic	.	.	.	.	.	.	.
Cumulic[6]	10	.	.	11	.	18	.
Typic	.	.	.	12	.	8	.
Unknown	.	5	6	11	.	.	7
FAMILY PARTICLE-SIZE CLASS							
Sandy-skeletal[7]	20	6	13	.	11	25	.
Loamy-skeletal	5	16	7	31	11	8	23
Loamy over -skeletal[8]	5	.	.	.	.	24	3
Clayey over -skeletal[9]	5	.	.	4	11	8	15
Sandy	5	.	.	.	11	8	.
Coarse-loamy[10]	5	6	20	27	.	.	9
Fine-loamy	30	33	40	27	33	8	38
Clayey	25	6	20	.	11	.	15
Other	.	33	.	11	12	19	.
WATER TABLE (cm, mean and 90% C.I.)[11]							
	62±15	28±9	25±6	63±9	25±24	65±16	49±11
No. observations	10	17	13	15	5	7	11
AVAILABLE WATER CAPACITY (mean and 90% C.I.)[12]							
	.16±.01	.	.	.17±.01	.13±.04	.13±.02	.17±.01
No. observations	19	.	.	23	7	12	9

APPENDIX D (cont.)

	CARO	DECE
n=	29	11
SOIL TAXONOMY (% Occurrence)		
Alfisols[1]	.	18
Entisols		
Cryaquents	28	9
Fluvaquents	.	.
Cryofluvents		
Aquic	.	.
Typic	.	9
Cryorthents	.	.
Inceptisols		
Cryaquepts[2]	3	.
Haplaquepts	.	.
Histosols		
Terric[3]	10	.
Typic[4]	3	.
Mollisols		
Cryaquolls		
Argic	3	18
Cumulic	24	18
Histic[5]	.	.
Typic	17	28
Cryoborolls		
Aquic	.	.
Calcic	.	.
Cumulic[6]	.	.
Typic	.	.
FAMILY PARTICLE-SIZE CLASS		
Sandy-skeletal[7]	3	.
Loamy-skeletal	.	18
Loamy over -skeletal[8]	.	.
Clayey over -skeletal[9]	3	18
Sandy	3	.
Coarse-loamy[10]	13	9
Fine-loamy	34	36
Clayey	27	19
Other	17	.
WATER TABLE (cm, mean and 90% C.I.)[11]		
	49±11	54±19
No. observations	11	10
AVAILABLE WATER CAPACITY (mean and 90% C.I.)[12]		
	.17±.01	.18±.01
No. observations	9	11

APPENDIX D (cont.)

---

[1]Includes Cryoboralf and Ochraqualf greatgroups.

[2]Includes Typic, Aeric, Histic, Humic, and Aeric Humic subgroups.

[3]Includes Borosaprist, Borohemist, Borofibrist, and Sphagnofibrist greatgroups.

[4]Includes Borosaprist, Borohemist, and Borofibrist greatgroups.

[5]Includes Histic and Thapto-Histic subgroups.

[6]Includes Cumulic, Pachic, and Argic-Pachic subgroups.

[7]Includes sandy over sandy-skeletal class.

[8]Includes loamy over sandy- and loamy-skeletal classes.

[9]Includes sandy-, loamy-, and clayey-skeletal classes.

[10]Includes loamy over sandy class.

[11]Includes only those soils with measurable water table within 1 m.

[12]Includes only non-organic surface horizons.

APPENDIX E. GLOSSARY

The following terms are defined as used in this report. The definitions should minimize misunderstanding resulting from variations in use among different specialists. Primary references include Hanson (1962) and Daubenmire (1968).

Accidental. A species that is found rarely, or at most occasionally, as scattered individuals in a given community type; often as a random or chance occurrence.

Alluvium. Sediments deposited on land by streams and rivers.

Anaerobic. A condition characterized by the absence of free oxygen.

Aquatic ecosystem. The stream channel or lake bed, the water, and the biotic communities associated with them, forming an interacting system.

Available water capacity. The capacity of a soil to hold water in a form available to plants, expressed in inches of water per inch of soil depth. Commonly defined as the amount of water held between field capacity and wilting point. Classes include:

Low.	0 - 0.12
Moderate.	0.13 - 0.17
High.	> 0.17

Canopy cover. The area covered by the generalized outline of an individual plant's foliage, or collectively covered by all individuals of a species within a stand or sample area. Canopy coverage is expressed as a percentage of the total area in the plot.

Classification. The orderly arrangement of objects according to their differences and similarities in attributes.

Community (plant community). An assemblage of plants occurring together at any point in time, thus denoting no particular ecological status. A unit of vegetation.

Community type. An aggregation of all plant communities distinguished by floristic and structural similarities in both overstory and undergrowth layers. A unit of vegetation within a classification.

Constancy. The percentage occurrence of a species within a given community type.

Depauperate. A condition characterized by an unusually sparse coverage of vegetation.

Ecotone. A transition zone or boundary between adjacent plant communities.

Fluvial. Pertaining to or produced by the action of a stream or river.

Forb. An herbaceous plant, usually broadleafed, that is not a graminoid.

Gleyed soils. Soils having an intense reduction of iron during soil development, or reducing conditions due to stagnant water, as indicated by base colors that approach neutral (blueish, grayish, or greenish), with or without mottles. In the more extreme condition, ferrous iron is present.

Graminoid. Grass or grass-like plant, such as *Poa*, *Carex*, and *Juncus* species.

Habitat type. An aggregation of all land areas potentially capable of producing a similar, stable plant community. A unit of land.

Herbaceous. Non-woody vegetation, such as graminoids and forbs.

Mottling. Variation of coloration in soils as represented by localized spots, patches, or blotches of contrasting color. Commonly develops under alternating wet and dry periods with associated reduction and oxidation environments. Mottling generally indicates poor aeration and impeded drainage.

Riparian ecosystem. Interacting system between aquatic and terrestrial situations, identified by soil characteristics, and distinctive vegetation that requires or tolerates free or unbound water.

Riparian species. Plant species occurring within the riparian zone. Obligate species require the environmental conditions within the riparian zone; facultative species tolerate the environmental conditions, therefore may also occur away from the riparian zone.

Riparian zone. A geographically delineated portion of the riparian ecosystem.

Seral. Refers to species or communities that are eventually replaced by other species or communities within a successional sere.

Sere. All temporary communities in a successional sequence.

Stable. The condition of little or no perceived change in plant communities that are in relative equilibrium with existing environmental conditions; describes persistent but not necessarily culminating stages (climax) in plant succession.

Stand. An existing plant community that is relatively uniform in composition, structural, and site conditions; thus it may serve as a local example of a community type.

Stream order. A classification of streams according to the number of the tributaries. Order 1 streams have no tributaries; a stream of any higher order has 2 or more tributaries of the next lower order.

Succession. The progressive changes in plant communities toward a steady state. Primary succession begins on a bare surface not previously occupied by plants, such as a recently deposited gravel bar. Secondary succession occurs following disturbances on sites that previously supported vegetation.

Wetland communities. Plant communities that occur on sites with soils typically saturated with or covered with water most of the growing season.

APPENDIX F. EASTERN IDAHO-WESTERN WYOMING RIPARIAN COMMUNITY TYPE FIELD FORM. USE THIS FORM ALONG WITH THE KEYS FOR IDENTIFYING THE COMMUNITY TYPES.

Name

Date Plot Number

Location

T. R. S.

Elevation % Slope

Topography Configuration

Topography	Horizontal Configuration
1 - Ridge	1 - Convex
2 - Upper Slope	2 - Straight
3 - Mid Slope	3 - Concave
4 - Lower Slope	4 - Undulating
5 - Bench or Flat	
6 - Stream Bottom	
7 - Wide Meadow	
8 - Seep or Spring	

Scientific Name	Code	Canopy Cover%
Trees		
Abies lasiocarpa	ABLA	
Picea engelmannii	PIEN	
Picea pungens	PIPU	
Pinus contorta	PICO	
Populus angustifolia	POAN	
Forbs		
Actaea rubra	ACRU	
Aster foliaceus	ASFO	
Galium triflorum	GATR	
Heracleum lanatum	HELA	
Helenium hoopsii	HEHO	
Mertensia ciliata	MECI	
Pedicularis groenlandica	PEGR	
Saxifraga odontoloma	SAOD	
Senecio triangularis	SETR	
Smilacina stellata	SMST	
Thalictrum occidentale	THOC	
Veratrum californicum	VECA	
Equisetum arvense	EQAR	
Graminoids		
Calamagrostis canadensis	CACA	
Carex aquatilis	CAAQ	
Carex microptera	CAMI	
Carex nebrascensis	CANE	
Carex pragracilis	CAPR	
Carex rostrata	CARO	
Carex simulata	CASI	

Scientific Name	Code	Canopy Cover%
Shrubs		
Alnus incana	ALIN	
Alnus sinuata	ALSI	
Artemisia cana	ARCA	
Betula glandulosa	BEGL	
Cornus stolonifera	COST	
Potentilla fruticosa	POFR	
Rhamnus alnifolia	RHAL	
Ribes hudsonianum	RIHU	
Salix boothii	SABO	
Salix drummondiana	SADR	
Salix eastwoodii	SAEA	
Salix exigua	SAEX	
Salix geyeriana	SAGE	
Salix lutea	SALU	
Salix planifolia	SAPL	
Salix wolfii	SAWO	
Graminoids		
Deschampsia cespitosa	DECE	
Festuca idahoensis	FEID	
Juncus balticus	JUBA	
Poa palustris	POPA	
Poa pratensis	POPR	
Poa trivialis	POTR	

COMMUNITY TYPE _____

EXAMPLES OF RIPARIAN COMMUNITY TYPES IN EASTERN IDAHO-WESTERN WYOMING

***Picea/Cornus stolonifera* c.t.**

A narrow riparian zone along the Greys River near Alpine, Wyoming (1 770 m, 5,800 ft.). The gently sloping bench supports a dense overstory of mature *Picea engelmannii*. The thick shrub stratum is dominated by *Cornus stolonifera*, and includes *Rosa woodsii* and *Ribes lacustre*.

***Picea/Galium triflorum* c.t.**

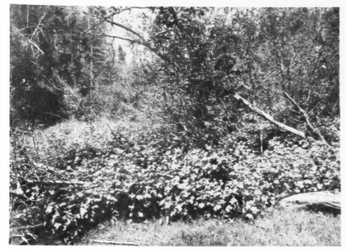
A mature overstory of *Picea engelmannii* and scattered *Abies lasiocarpa* dominates a gently sloping bench north of Alpine, Wyoming (2 040 m, 6,700 ft.). The lush undergrowth contains *Actaea rubra*, *Galium triflorum*, *Smilacina stellata*, and *Aconitum columbianum* as prominent forbs.

***Populus angustifolia/Poa pratensis* c.t.**

Relatively dense *Populus angustifolia* creates the overstory of this community occurring on a broad river terrace near Swan Valley in eastern Idaho (1 770 m, 5,800 ft.). *Poa pratensis* dominates the undergrowth.

***Cornus stolonifera/Galium triflorum* c.t.**

A narrow stringer community along the fast flowing Big Elk Creek in eastern Idaho (1 820 m, 5,960 ft.). *Cornus stolonifera* creates the dense shrub stratum; most forbs and graminoids are inconspicuous.



Alnus incana/Ribes hudsonianum

A narrow riparian zone in Table Rock Canyon (1 830 m, 6,000 feet) near Heise, Idaho. *Alnus incana* and the low shrub *Ribes hudsonianum* cover the stream. *Agrostis stolonifera*, *Carex microptera*, and *Heracleum lanatum* occur in small openings.

***Potentilla fruticosa/Deschampsia cespitosa* c.t.**

A broad valley bottom meadow near Pocatello, Idaho (1 850 m, 6,080 ft.). Scattered *Potentilla fruticosa* is the dominant shrub; the community also includes *Artemisia cana*. The dominant graminoids include *Deschampsia cespitosa*, *Carex praegracilis*, and *Poa pratensis*.

***Artemisia cana/Festuca idahoensis* c.t.**

A broad valley bottom adjacent to North Horse Creek, near Merna Junction, Wyoming, supports a dense stand of *Artemisia cana* (2 500 m, 8,200 ft.). The undergrowth includes *Festuca idahoensis*, *Bromus ciliatus*, and *Geum triflorum*.

***Salix geyeriana/Carex rostrata* c.t.**

An alluvial bench near Swan Valley, Idaho, is dominated by large scattered clumps of *Salix geyeriana* (1 720 m, 5,640 ft.). The undergrowth consists of *Carex rostrata*, *Carex interior*, and *Equisetum arvense*.

***Salix geyeriana/Poa pratensis* c.t.**

A broad alluvial bench (2 030 m, 6650 ft.) along Tincup Creek near Freedom, Idaho, supports scattered mature clumps of *Salix geyeriana*. Dominant graminoides include *Poa pratensis*, *Deschampsia cespitosa*, and a mixture of carices. The prominent forb is *Potentilla gracilis*.

***Salix boothii/Carex rostrata* c.t.**

A relatively narrow alluvial bench near Swan Valley above Palisades Reservoir, Idaho (1 830 m, 6,000 ft.). The shrub canopy, dominated by *Salix boothii* and *Salix drummondiana*, averages about 0.5 m in height. *Carex rostrata* is conspicuous in the undergrowth.

***Salix boothii/Smilacina stellata* c.t.**

A broad alluvial flat west of Freedom, Idaho (1 950 m, 6,400 ft.) The dense overstory contains *Salix boothii*, *Salix drummondiana*, *Betula glandulosa*, and *Lonicera involucrata*. A mixture of forbs, such as *Thalictrum occidentale*, *Smilacina stellata* and *Solidago canadensis*, comprise the undergrowth.

***Salix boothii/Poa pratensis* c.t.**

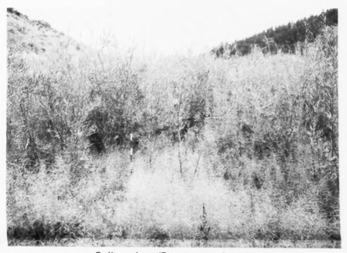
A relatively narrow notch-shaped valley bottom along Elk Creek near Irwin, Idaho (1 865 m, 6,120 ft.) The dense overstory includes *Salix drummondiana*, *Salix boothii*, and *Salix exigua*. *Poa pratensis* is the dominant undergrowth species.

***Salix wolfii/Carex aquatilis* c.t.**

A gently sloping bench within a subalpine meadow near Grays Lake, Idaho (2 240 m, 7,360 ft.) *Salix wolfii* is the only shrub present; the undergrowth is dominated by *Carex aquatilis*, *Carex rostrata*, and *Pedemonium occidentale*, and a dense carpet of mosses.

***Salix wolfii/Carex rostrata* c.t.**

A broad valley bottom near the head of the Little Greys River east of Alpine, Wyoming (2 040 m, 6,700 ft.). The community consists almost entirely of *Salix wolfii* and *Carex rostrata*.



***Salix exigua/Poa pratensis* c.t.**

Salix exigua dominates this broad alluvial bench near Swan Valley, Idaho (1 630 m, 5,360 ft.). A mixture of graminoids, including *Poa pratensis*, *Glyceria elata*, and *Carex lanuginosa*, characterize the undergrowth.

***Carex microptera* c.t.**

An old sediment-filled beaver pond north of Grays Lake, Idaho (2 000 m, 6,560 ft.). The graminoid community includes *Carex microptera*, *Carex rostrata*, and small amounts of *Calamagrostis canadensis*.

***Carex rostrata* c.t.**

An inactive beaver pond south of Swan Valley, Idaho (2 000 m, 6,560 ft.) *Carex rostrata* and small amounts of *Carex aquatilis* dominate the raised hummocks separated by stream channels. The community is bordered by *Salix boothii* below the dam.

***Carex nebrascensis* c.t.**

A narrow subirrigated meadow north of Driggs, Idaho (1 850 m, 6,080 ft.). The community is composed almost entirely of *Carex nebrascensis*.

***Deschampsia cespitosa* c.t.**

A broad, almost flat meadow east of Ashton, Idaho (1 960 m, 6,440 ft.). The community includes *Deschampsia cespitosa*, *Carex lanuginosa*, and *Camassia quamash*

Wetland Communities

A broad pond margin surrounding open water in a basin east of Ashton, Idaho (1 840 m, 6,040 ft.). The dominant wetland species include *Eleocharis pauciflora* and *Nuphar polysepalum*, depending upon water depth.

Published as part of - Riparian Community Type Classification for Eastern Idaho-Western Wyoming; R4-Ecol-85-01, 1985

USDA Forest Service
Intermountain Region

☆ U.S. GOVERNMENT PRINTING OFFICE: 1986-0-580-655